FLIGHT

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Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list—

1930

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Feb. 6 .... **"Modern Aerodynamical Research in Germany." Lecture by Mr. J. W. Maccoll before R.Ae.S.**

Feb. 7 .... **British Empire League Luncheon to Lord Thomson, at British Empire Club, 12, St. James's Square.**

Feb. 13 .... **"Recent Work on the Autogiro." Lecture by Senor J. de la Cierva before R.Ae.S.**

Feb. 19 .... **"Gliding." Lecture by Dr. Walter Georgii before R.Ae.S.**

Feb. 27 .... **"Latest Developments of Aero Engines." Lecture by Mr. A. J. Rowledge before R.Ae.S.**

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Mar. 6 .... **"Resistance of Air-Cooled Engines and the Townend Ring." Lecture by Maj. F. M. Green and Mr. H. C. H. Townend before R.Ae.S.**

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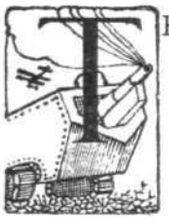
EDITORIAL COMMENT



THAT only four aircraft firms were sufficiently interested in the subject of Certificates of Airworthiness to be represented at the lecture by Mr. Howard before the R.Ae.S. last Thursday seems regrettable, even bearing in mind that by far the largest proportion of our aircraft firms is still engaged exclusively on the production of service types. Unless the firms can agree to put up a united front, there is not likely to be any material change in the regulations which at present handicap the designer and constructor of civilian aircraft.

Certificates of Airworthiness

The Air Ministry is "benevolent," and its representatives have shown willingness to meet the manufacturer in many little ways of lessening the effects of the C. of A. regulations. But the Air Ministry has not the same vital interest in the solution of the problem as have the constructing firms, and if the latter do not show any very great interest in the subject, surely the Air Ministry cannot be blamed for taking its time over coming to a decision.

On the whole, Mr. Howard's paper was a very fair and well-reasoned exposition of the present state of affairs, although he seemed a little inconsistent when he stated in one place that it was not correct to suppose that the regulations were on a par with a law prohibiting a man from marrying his grandmother, while in another he said that if the law did not lay down minimum requirements, the designer would lay them down for himself, and also that the law should only impose those restrictions which the experienced designer would impose upon himself.

To us it appears that the lecturer failed a little in appreciating the real points in the matter. He dealt faithfully with such restrictions as take-off requirements and load factors, but did not really touch to any extent on the subjects that really matter. It is not the fact of a machine having to pass certain take-off and climb tests that tend to make machines expensive to build. Or at least these tests add but a small percentage to the cost. It is the system whereby an aircraft designer and manufacturer has, practically

speaking, his materials decided for him by official regulations, and the inspection by Government officials to see that the materials are up to specification, and that during construction their characteristics have not been changed; all these are the items mainly responsible for the increase in cost of production.

But even taking the subjects of take-off and climb requirements, and load factors, the system appears illogical. The Government can stipulate that a machine must be capable of clearing a height of 20 m. in a distance of 750 m., and the Government establishment at Martlesham can ascertain whether or not the machine does, in fact, fulfil this condition; but no official regulation can make sure that the owner or operator of the machine will not subsequently try to get the machine to clear that obstacle in, for example, 600 m. So that whatever minima are called for by official regulations, one can have no guarantee that the aircraft will not later be asked to do something of which it is not capable.

So also with load factors. Mr. Howard admitted that no machine is so strong that it cannot be broken in the air if a pilot carries out certain manœuvres. Therefore load factors are no guarantee against abuse of the machine. But the point seems to us to be that the Government officials have little or no knowledge of how a machine is likely to be used during its service. This applies more particularly to privately-owned aircraft. The manufacturer, on the other hand, will very soon learn from dissatisfied customers if his machine is giving serious trouble. And, be it noted, all the Government regulations in the world will not prevent this happening. A machine can have been built according to every regulation ever laid down, and have passed all the official tests imaginable, and yet it can be a thoroughly bad machine from the practical user's point of view.

It all seems to boil down to this that, at least where private machines are concerned, the present system is irksome and expensive, and does not in practice produce results commensurate with the large machinery involved.

Mr. Radcliffe (of "Gloster" technical staff) suggested, and we quite agree, that for private aircraft it should suffice if the manufacturer supplied to the Air Ministry, in the case of a new type, complete stress calculations as proof not only that the firm was capable of carrying out the calculations, but that it had so carried them out. In the case of machines to be used on regular air routes or for other carrying of *paying* passengers, it is probably just as well to retain some form of Government supervision. But for private machines the manufacturer's regard for his reputation can, we think, be relied upon to do all that is necessary in the way of safety precautions.

We have become so accustomed to Government regulations that it is almost an effort to imagine an industry without them, but we do feel that something must be done, and done quickly, if the British manufacturer is not to be handicapped out of existence. At present the only type of aircraft which does not require, by law, any load factors at all is the glider! Incredible as it may sound, a man is still at liberty to build a glider that is structurally weak and to go and kill himself on it. How Farnborough came to overlook the glider we cannot imagine. Can it be that it is out of chivalry towards a type of aircraft that is "powerless"?

An Indian Air Force

The Secretary of State for India has announced, in a written answer to a question:—"The creation of an Indian Air Force forms part of the accepted policy of Indianisation, and is already under consideration. Matters have not yet advanced far enough to enable me to give any details as to the constitution or future functions of such a force."

As everyone knows, there is a highly efficient Indian Army; there is a Royal Indian Marine; and in the dim and distant past there was an Indian Navy. The last surviving retired officer of the navy, if we remember right, was on duty at the funeral of King Edward VII. It would seem, therefore (if it be accepted that an Indian officer is as good as a British officer—a proposition which it is now heresy to question), that there is nothing unreasonable in the project for creating an Indian Air Force. We remember that at least three Indian gentlemen held commissions as pilots in the R.F.C. and R.A.F. during the war, and fought with great gallantry. One was Lieut. Malik Singh, who comes of the grand fighting stock of the Sikhs, and is now a member of the Indian Civil Service. Another was 2nd-Lieut. E. S. C. Sen, a Bengali Brahman, and a nephew of the late Maharani of Cooch Behar. He was taken prisoner by the Germans, and was well treated by them. The third was Lieut. Indra Lal Roy, D.F.C., also a Bengali, a son of the Director of Public Prosecutions in Calcutta, and an Old Pauline. He was officially credited with bringing down nine enemy aircraft and was killed in air combat on July 22, 1918.

Quite recently a number of young Indians have learnt to fly in England, and some have bought their own aeroplanes. Two of them, Messrs. Kabali and Man Mohan Singh, have attempted to win the Aga Khan's prize for the first Indian flight to India.

There can be no reason at all why large numbers of Indians should not become good pilots, and the records of the Indian Army, as well as of Indian sport, show that there is no lack of courage in many of the Indian races. Presumably at first the Indian Air Force would include both British and Indian personnel. The pilots could be drawn largely from the Indian races. The rank and file of the mechanics would naturally all be Indians. The all-important connecting link would be the inspectors and senior N.C.O.'s. These would have to be British. But such a state of affairs would not satisfy the cause of Indianisation. An all-Indian force will be looked on as the goal.

It is as regards aircraftmen that we should feel dubious of India's capacity to raise an efficient air force. There are in India many artisans of considerable proficiency in wood work and metal work. The best of them come from the Punjab. Many Sikhs make quite good mechanics, and there is one tribe of Punjabi Mussulmans which supplies nearly all the regimental armourers for the regiments of the Frontier Force. These last are excellent and most conscientious workmen, and can be absolutely trusted. But the average Indian mechanic is very casual and untrustworthy. The care of aeroplanes demands a meticulous attention to detail, and a conscience which will leave nothing to chance. The lives of the airmen depend on the thoroughness with which aircraft are kept in perfect flying trim. We gravely doubt if India could provide sufficient aircraftmen of the right sort to make an Indian Air Force a reasonably safe proposition.

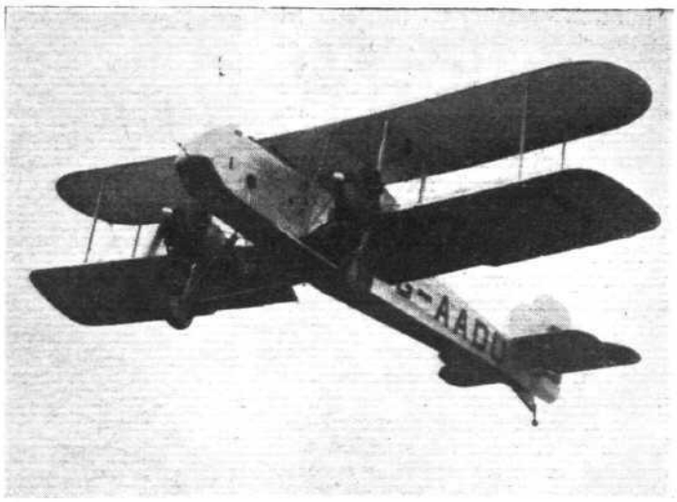
THE GLOSTER SURVEY AEROPLANE

Flight by Lord Thomson

ON Saturday, January 25, the Gloster Survey Aeroplane—two Jupiters—was formally taken over by the Aircraft Operating Co. Ltd., to whose specifications it had been designed. On the initial flight at Heston, after the taking over of the machine, Lord Thomson and Mr. Montague, Secretary and Under-Secretary of State for Air, respectively, were passengers in the machine. On the second flight, Sir Edward Crowe, K.C.M.G., O.B.E., Comptroller General of the Department of Overseas Trade, and Sir Sefton Brancker were passengers.

Before the ceremony at Heston, Lord Thomson and Mr. Montague visited the laboratories and drawing offices of the Aircraft Operating Co. at Hendon. The original intention had been that they should fly across to Heston, but the weather was too foggy to make this advisable, so the journey was made by road. The distinguished visitors, among whom were Sir Cecil Bottomley, K.C.M.G., C.B., of the Colonial Office, and Colonel M. N. MacLeod, D.S.O., M.C., of the Air Survey Committee, War Office, were received by Mr. Alan Butler, Major Hemming, Major Mayo and Major Cochran-Patrick, D.S.O., M.C., of the Aircraft Operating Co. The Survey machine was piloted by Flight-Lieut. Saint, test pilot of the Gloster firm, and he handled her with very great skill. Though it is rather difficult to make one's voice heard in the cabin, the steadiness of the machine in the air is very marked, and the pilot put her from one manœuvre into another with absolute smoothness and freedom from jerking. It was extremely interesting to watch the left-hand turns with the starboard Jupiter throttled right down and only ticking over. She went about with a minimum of rudder and aileron. Her speed range was also very good. It was Sir Edward Crowe's first flight, and he said that he enjoyed the experience very much indeed.

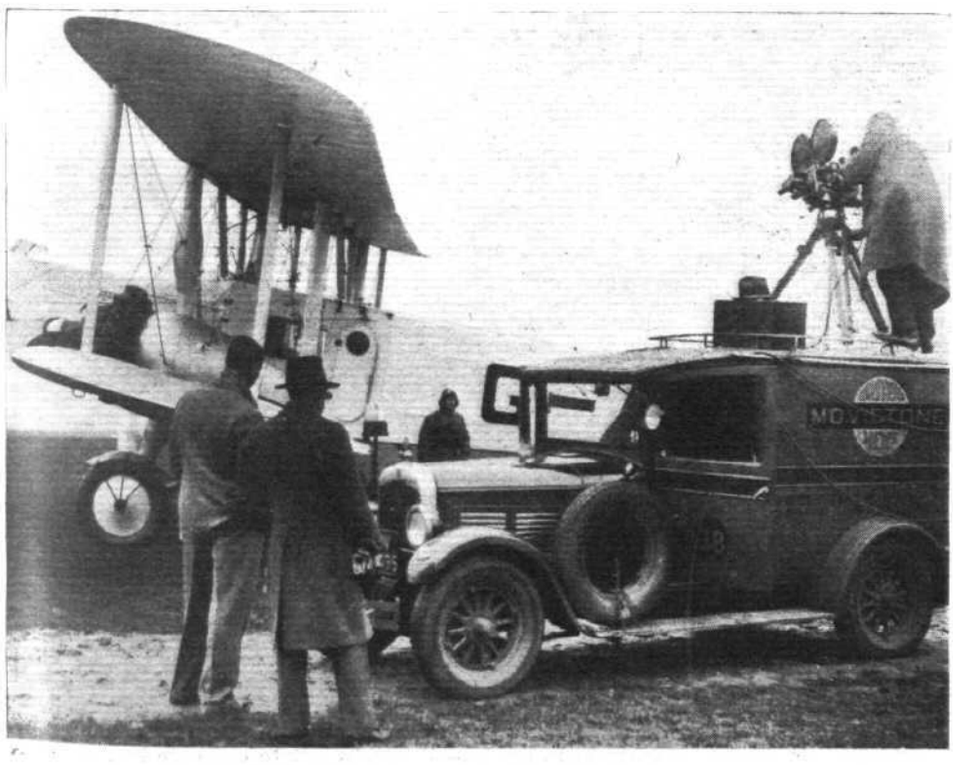
After the flights the party was entertained to luncheon by the Gloster and Aircraft Operating Companies, with Mr. Butler in the chair. Proposing the health of the Air Minister, the chairman said that he looked on this occasion as the birth of a new industry. Lord Thomson and Mr. Montague had been the first passengers in the first aeroplane designed for aerial survey. He regarded co-operation between the Government and the industry as the way to commercial success. In the past it had been impossible to tender for the survey of vast impenetrable tracts because of the unreliability of the aeroplanes available. It was also impossible to order a special machine without having contracts on hand. The Gloster firm had built this machine for them on very fair terms. When he spoke of the unreliability of aircraft, he considered this form of conveyance as reliable as any other; but they could not risk a forced landing in the bush from engine failure. This machine had played an important part in getting them the contract for the survey of 63,000 square miles in Northern Rhodesia. He congratulated Lord Thomson on the good example which he set by flying everywhere. Flying had introduced such a revolution in survey work, that they now ran the risk that their claims would not be taken seriously. But he had received a message from Lord Passfield, Secretary for the Colonies, in which he stated that their previous survey in Northern Rhodesia had given satisfaction to the Colonial Government. It was only by securing contracts for large areas that they were able to quote low rates, and he would like to suggest that the Air Ministry should help them in securing more large contracts.



The Gloster Survey machine flying with starboard engine throttled right down, and propeller ticking slowly over.

Lord Thomson, in his reply, said that in flying he was only doing what every advanced person now does. He mentioned that on a recent flight to the Continent a small red-haired boy among the passengers had asked him: "Is this your first flight?" and then added, "It is my fifth. I always make Daddy send me this way." Lord Thomson said that air surveying was going to do a great deal for the development of the Empire. They would not be able to develop the Empire rapidly without more flying. He always impressed that point, whenever he had the chance, on every Colonial Governor or Premier of a Dominion. Of course, to a Secretary of State, a concern which did not ask for a subsidy was like a spring of water in the wilderness. He had been surprised at the low figure Mr. Butler quoted for each square mile surveyed. When he had been on a ground survey of the sources of the Niger, his mess bill alone had been as high as that figure per square mile surveyed. There was no difficulty in persuading intelligent people of the advantages of using aircraft. The difficulty was to convince the Press. However, he saw two journalists present who were highly intelligent people. (We shall not attempt to guess which two of the journalists present were thus distinguished by the Air Minister, though we may remark *en passant* that there were two representatives of FLIGHT present.—ED.)

Lord Thomson ended by saying that the Air Ministry helped those who helped themselves. The



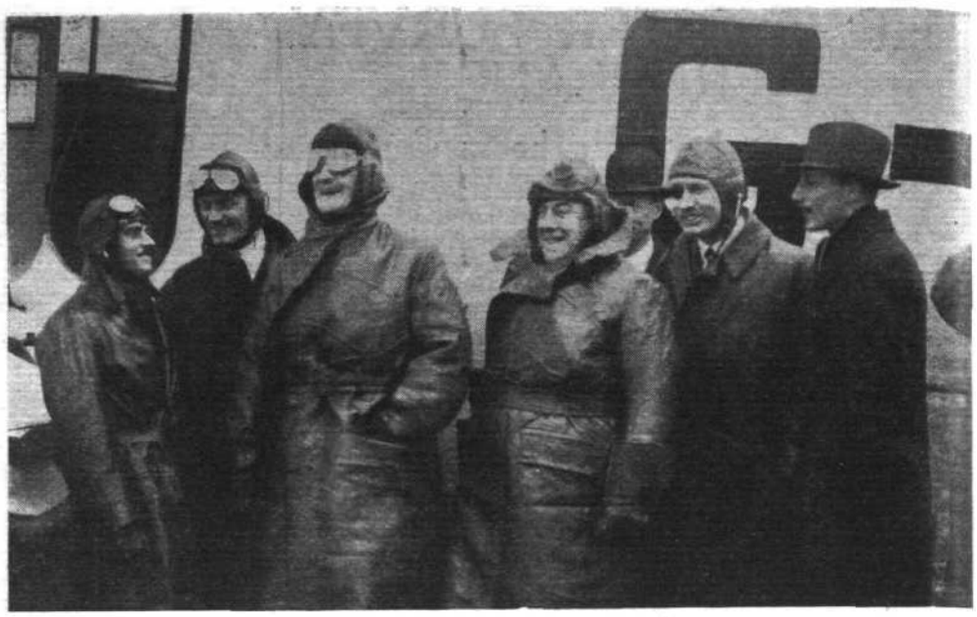
Lord **Thomson gives his impressions of his flight to the microphone.**

Aircraft Operating Co. had started in the right spirit, and, so far as in him lay, he would help them.

Mr. Burroughes, of the Gloster firm, proposed the health of Mr. Montague. He said that it had been very pleasant for a constructing firm to work for and with people who knew just what they wanted.

Mr. Montague said that this survey aeroplane was quite revolutionary from the commercial point of view. It might be useful for more than survey. Governors could travel in it, and so could explorers and mining engineers.

Sir Edward Crowe proposed the health of commercial aviation and its director in a very witty speech. He said that he had been a schoolfellow of Sir Sefton, and the latter had been "an extremely and incredibly objectionable small boy." A very mild divinity master had once said to him "You almost make me fly into a temper." Even at that early age Sir Sefton was making people fly. Hehimself had grey hair, but then he had never flown until to-day. Sir Sefton still looked young because he was always flying. Up in the air you saw the wrinkles on the face of the earth but kept them off your own face.



From Left to Right :—Mr. Alan Butler, Flight-Lieut. Saint, Lord Thomson, Mr. Montague, Major Mayo (half hidden), Major Hemming, and Major Cochran-Patrick.

From Right to Left :—Sir Edward Crowe, Sir Cecil Bottomley, Mr. Burroughes, Mr. Mercier (Private Secretary to Mr. Montague).

Sir Sefton replied that he would return good for evil. He would say that to flying enterprises the Department of Overseas Trade was worth far more than the Air Ministry. This survey aeroplane was a delightful machine, and was really wasted on survey work. It would make an ideal private yacht.

While the party was at lunch, the cameras were fitted into the machine, and they were afterwards inspected. The machine will be flown out to Northern Rhodesia by Mr. Alan Butler, while Major Cochran-Patrick will go out with the rest of the party and equipment by the antiquated methods of travel.

The Jask Disaster

THE Air Ministry issued on January 23 its report on the accident at Jask in Persia on September 6, 1929, when the pilot, Capt. A. E. Woodbridge (the man who once wounded and shot down von Richthofen), one mechanic, and one passenger were killed. The report runs as follows :—

On receipt of information concerning the accident which occurred to Imperial Airways Limited's aeroplane "City of Jerusalem" (G-EBMZ) at Jask, Persia, on September 6 last, the Government of India deputed two officers, namely, Wing-Commander R. H. Verney, O.B.E., Engineer Staff, Royal Air Force, India, and Mr. A. S. Lane, B.Sc., Inspector of Aircraft, Department of Civil Aviation, India, to proceed to the scene in order to collect all evidence available and to report thereon.

The Government of India and the Air Ministry, after duly considering the evidence so obtained and the opinions expressed in the report of these officers, have arrived at the following conclusions :—

(1) The pilot, when he started on the flight, had reasonable grounds for expecting to reach Jask before nightfall.

(2) In attempting to execute a night landing on the aerodrome, the pilot misjudged his height above the flare path, with the result that the aircraft stalled and crashed to the ground, wrecking the undercarriage and port planes.

(3) The outbreak of fire was caused by the petrol from the damaged tanks becoming ignited by the burning wing-tip flare, the port plane having been swept back alongside the fuselage.

(4) All possible assistance was rendered to the injured by the staff of the Indo-European Telegraph Department at Jask with the limited resources at their disposal, and the highest commendation is due to them for their efforts in this respect.

(5) As the outcome of the investigation into the accident, additional precautions are being adopted. In this connection, however, it should be recorded that the wing-tip flares used on the aeroplane were of a type which is in general use by the Royal Air Force and which is still regarded as the most satisfactory form of emergency landing light.

Oxford Blue for the R.A.F.

H. R. A. EDWARDS (Westminster and Christchurch), who rowed in the Oxford crew four years ago, has gone into residence at Oxford again in order to win a University commission in the R.A.F. He is now rowing as No. 5 in this year's Oxford boat.

U.S. Aircraft Built in Canada

ONE of the largest aircraft constructing firms in the United States, the Consolidated Aircraft Corporation of Buffalo, has announced its intention to establish a plant in Ontario to produce light aircraft to compete in export trade with British and foreign markets.

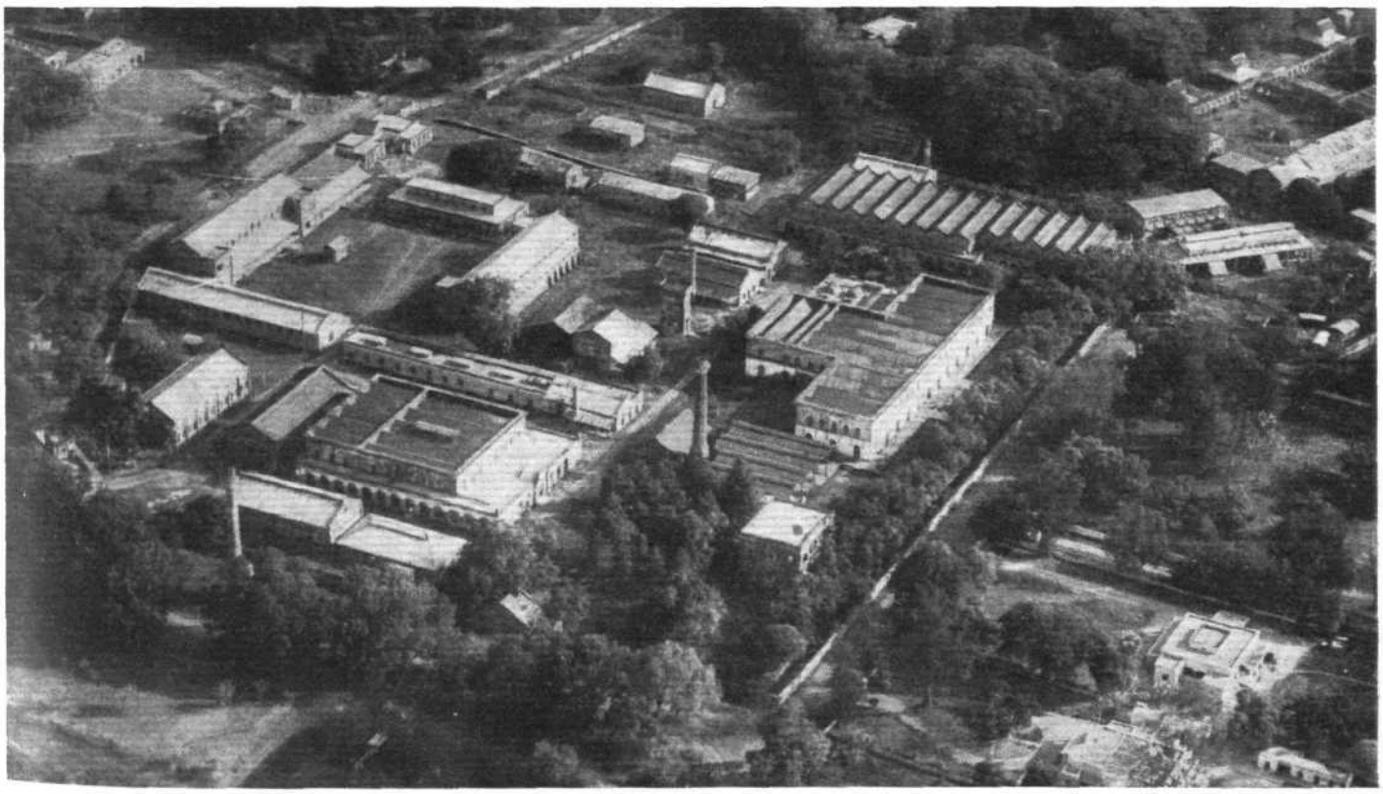
PROFITING BY AIRCRAFT

IT is refreshing in these days to hear of a usage for aircraft which really pays its way and, moreover, does so without any form of subsidy either direct or indirect. Air lines carrying passengers have certainly not reached this stage, while those carrying mails only pay by getting liberal contracts at cut prices which are in effect subsidies; air survey operations, however, not only pay, but do so without any form of subsidy and at the same time provide the various Governments with a means of having their lands surveyed at a cost far below that at which they themselves could do it. There have been Governments who have thought that by buying an aeroplane and taking photographs, they would be able to use those photographs together with their survey departments organisation and produce maps at an economical figure, but this cannot be done at rates to compete with those the established air survey companies are able to offer because, if for no other reason, the latter are able to spread their overhead charges over many surveys while the individual Government would be landed with the air equipment which they would then have to dispose of at the end of the survey without having had many months use out of it, hence it cannot be too strongly impressed on all bodies who have survey work to carry out that their best way is invariably to get in touch with a well-established air survey company. The advantages of air survey over a survey carried out with only a ground staff are many, but two of them are more than sufficient to turn the scales entirely in favour of the aerial method, and these are cost and speed. The records of the air survey companies show that the cost is invariably decreased by a very large percentage indeed, and the time saved may easily be a matter of many years, it is nothing for a survey which would take, say, 3 to 4 years to complete on the ground, to be comfortably finished in one year by the help of aircraft.

It is a sign of prosperity that a firm like the Fairey Aviation Co., Ltd., should enter this field of commercial aircraft operation, especially as they have up to the present left commercial aviation alone, now, however, they have obtained the controlling interest in the Air Survey Co. and the newly-constituted board of Directors consists of Sqd.-Ldr. M. E. A. Wright, Col. C. H. D. Ryder, R. C. Kemp, A. G. Hazell, F. P. Raynham, Capt. N. Macmillan, with their head office at 3, Grosvenor Gardens, London, S.W.1.

The work done so far has mostly been carried out with D.H.9 (Puma) aircraft, but for the latest contract in the Sudan, the Fairey Aviation Co. have modified two Fairey III F. machines. These are practically the same as the standard service III F. with the following modifications. The engine used is a Jaguar VI C., which gives a good performance at the height required for photography—about 15,000 ft. in the Sudan—and also allows a saving in weight over the water-cooled engine. In order to allow the pilot to get the best view vertically over the side of the cockpit, the sides of the fuselage have been flattened by the amount of the space between the fairing and the fuselage proper, as this is not now required for the guns. To further increase this view the roots of the lower planes have been left uncovered, so that the pilot may look through them, by a space from the fuselage to the first wing rib. Care has been taken in slightly modifying the fairing around the pilot's cockpit also to secure the best possible view.

The rear cockpit has been arranged to take the "Eagle"



The old Ammunition Factory at Dum Dum Aerodrome, Calcutta, which has now been turned into the main headquarters of the Air Survey Co. in India. The spaciousness of the buildings allows ample room for drawing offices and dark rooms besides workshops and stores.

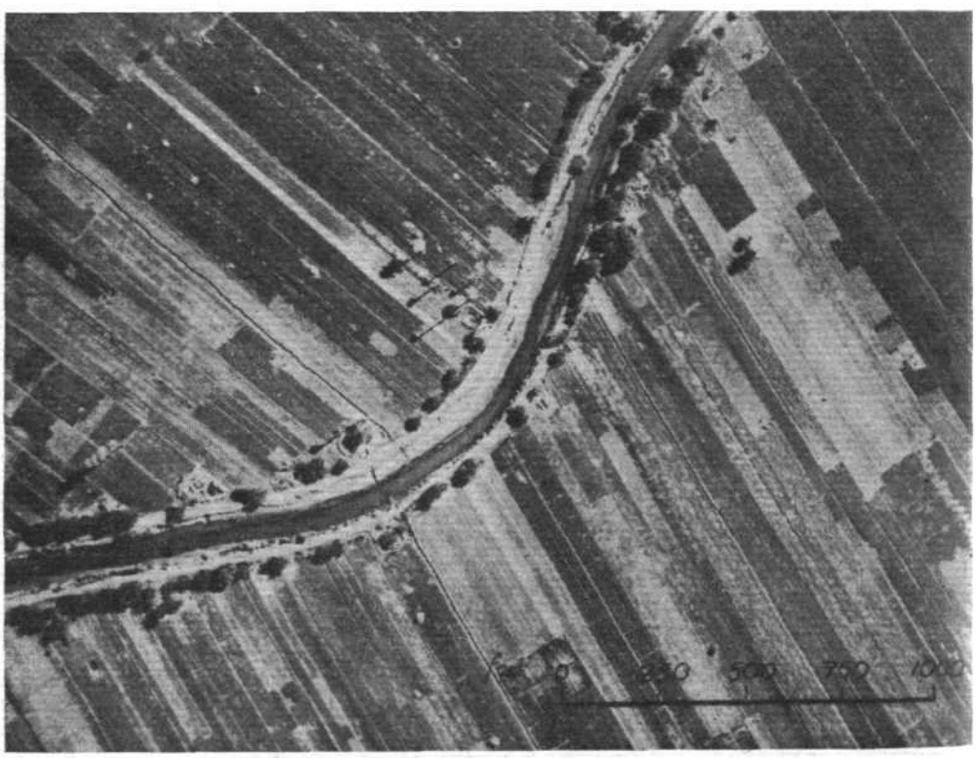
The United Services Club at Lucknow : A typical view showing Indian architecture, this building used to be a Palace. The River Gumti flows in the foreground.

aircraft camera on a mounting specially designed and developed by the Fairey Co., which permits both vertical and oblique photography, while the whole mounting is removable, so that three extra seats may be placed in the cockpit and the machine used for transport of the ground personnel when required. The fuel capacity has been increased to 136 galls., and further tanks for another 100 galls. can be fitted to the lower planes when wanted.

The first of these machines has been delivered by air and has arrived at Juba, its destination in the Sudan. Mr. Haines is the pilot who flew the machine out and the route was Paris, Marseilles, Pisa, Rome, Catania, Malta, Tunis, Tripoli, Benghazi, Cairo, Khartoum, Mongala, Juba.

The Air Survey Co., Ltd., of 3, Grosvenor Gardens, S.W.1, was formed by Mr. R. C. Kemp in the autumn of 1924, to carry on the work started by Mr. Kemp some 14 months previously. Mr. Kemp's organisation had successfully carried out the survey of 1,400 square miles in the Irrawaddi Delta, in conjunction with the Survey of India. This survey was the most ambitious undertaking of its kind undertaken up to that date, and was an unqualified success. The object of the survey was to provide topographical and forest stock maps. The former were compiled by Major C. G. Lewis, of the Survey of India, while the stock maps were compiled by the Burma Forest Department from the photographs supplied by Mr. Kemp. Major Lewis was also responsible for the ground control, which he did by triangulation along the banks of the main delta rivers. The work was completed in a quarter of the time, and at half the cost of a survey on the ground. The accuracy proved to be as high as the usual method, and in addition, the extra amount of detail recorded proved to be of the greatest value. Mr. Kemp's air survey organisation operated from Rangoon, some 90 miles distant from the centre of the area being surveyed. Two D.H.9 aeroplanes, fitted with Armstrong Siddeley "Puma" engines, were converted into seaplanes by fitting floats specially built to Mr. Kemp's requirements. This was the first time this type of aeroplane was used as a seaplane, and it proved a great success, so much so, in fact that it was used as the Air Survey Company's standard type of survey seaplane until the autumn of 1927. The cameras used on this survey were made by the Williamson Manufacturing Co., of Willesden, and the company have almost continuously used the Williamson products right up to the present day. In the earlier cameras, plates were used, but the "Eagle" film camera was adopted at the end of the year 1927. Since then, the Williamson Manufacturing Co. have made a modified model of the "Eagle" camera, specially for the Air Survey Co., Ltd., which has a greatly improved covering power, and probably covers more country on one photograph than any other single-lens camera on the market. Messrs. Ross contributed greatly to the success of this model by research done in conjunction with the Williamson Manufacturing Co. and the Air Survey Co., which has lead to the design of a lens with very exceptional powers.

The survey of the Irrawaddi Delta marked the beginning of air survey as it is known to-day, and provided the first successful survey of its kind which was needed to prove to the world that this method of surveying was not only practicable,



This vertical should be compared with the one on the opposite page as a comparison of different types of cultivated country. This is irrigated land in Egypt with a cotton crop growing and the subsidiary irrigation ditches can be seen between the plots. Each strip is one plot.

but had come to stay. The Government of Burma and the Survey of India are to be congratulated for their enterprise in undertaking this novel experiment.

From that date, air surveys have become increasingly frequent, and Mr. Kemp's organisation carried out several smaller surveys in the same year as that in which they completed the Delta of the Irrawaddi, including the town of Rangoon and the oil fields at Yenangyoung.

The Air Survey Co., Ltd., commenced its operations with the survey of the Tennasserim Forests in Burma, an area of 15,000 square miles. This was a very different type of survey to the one brought to a successful conclusion a few months previously, in that its primary object was to provide a working knowledge of the stock of timber contained in that vast area of hills in Southern Burma, bounded on the east by Siamese territory on the watershed of the peninsula.

Two seaplanes were again used, operating from sheltered water along the Tenasserim coast line, with a seagoing motor launch brought specially from England, acting as a floating base.

Two officers of the Burma Forest Service, namely, Major Scott and Mr. Robins, were carried in the survey 'planes, and with their specialised knowledge of the evergreen forests they were able to sketch in on normal topographical maps the various types of timber.

Strips of photographs were taken in addition at specified intervals to assist in the interpretation of the observer's reports and sketches.

This work provided another and yet more striking example of the saving in time and expense by the use of air survey. The cost of the work amounted to about 8*s*. per square mile, whereas, by the estimates of the Chief Conservator of Forests, Burma, it would have cost £1 2*s*. 6*d*. per square mile, and would have taken some 20 years to complete the work by the usual methods with the staff which he had available.

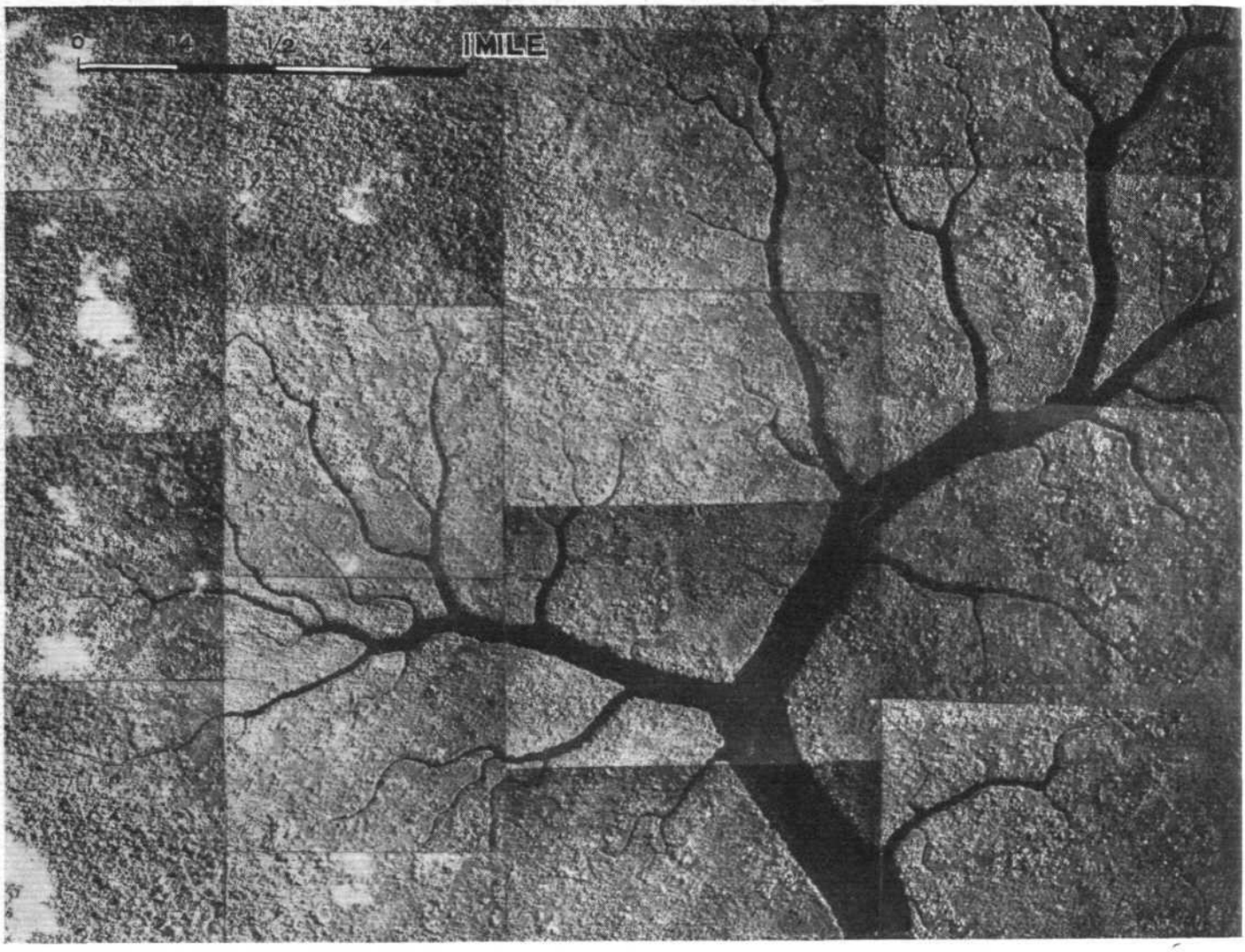
The Air Survey Company's Depot at Monkey Point, Rangoon : Their slipway can be seen leading from the sheds in the foreground.

From Burma, the Air Survey Co., Ltd., moved their survey party to Borneo, where in the summer of 1925, they commenced a topographical survey of 1,400 square miles in Sarawak and Brunei for the Anglo-Saxon Petroleum Co., Ltd. This work was very similar in every way to the Irrawaddi Delta Survey, except that the climatic conditions in Borneo are not nearly so suitable for air survey as those prevailing in Burma, with the result that the survey took much longer to complete. On the other hand, the area was not intersected by water channels as was the Irrawaddi Delta, so that ground survey would have been exceptionally slow on account of the difficulty in making transport arrangements. Maps were prepared by the company on a scale of 1/50,000, and photographic plans of certain sections of the area on a scale of 1/10,000.

In March, 1926, the same survey party moved down the coast of Sarawak to Sibu in the Rejang Delta, from where a survey of some 2,400 square miles was undertaken for the Raja of Sarawak.

The country was flat, densely wooded, and intersected by innumerable rivers, all of which would have made the work of the surveyor on the ground a long and costly business. The rapidly-increasing demand for land by natives for rubber growing and cultivation of all descriptions, made it essential to have an accurate and very detailed map of the area. Even the rough mosaic compiled by the field party provided sufficient information for development schemes to be put in hand at once. The

This vertical also shows cultivated land but this time in Bengal and it is not irrigated. In both types the "bunds" marking the division of the plots are mud walls about 1 ft. high. In both pictures each plot is a unit for tax purposes, and it is easy to see how labour is saved when surveyed by air.



A vertical view of a dense forest in the Rejang region of Borneo showing the head of a tidal river. The trees are packed close to each other and are all 90-100 ft. high. The smooth looking portions are merely a different type of tree and are not grass!

experience gained during the previous contract enabled numerous improvements to be made in the working plans. Rather more than three-quarters of the area was covered by vertical photographs, and the remainder by obliques. Owing to the very small amount of ground control available, strips 45 miles in length had sometimes to be made between control points. The accuracy obtained on such strips was highly satisfactory, and it was found possible to fix points half-way along such strips, with a maximum possible error of 120 ft. All photography was carried out at 8,000 ft. The rate of working was high on good days, but only on one occasion were the operations not interrupted by cloud formation.

Mr. F. P. Raynham, well known in British aviation circles, was in charge of the field operations of this survey, and this side of the work was completed in four months, with entirely satisfactory results.

The final maps were prepared in the company's offices in London, on a scale of 4 in. to 1 mile.

A view from the air showing how the water in a river in Borneo is coloured dark until it meets the sea, where the division looks almost like a mud bank

In August of the same year, a second expedition was formed with Capt. J. Durward at its head, and was sent into the Federated Malay States, where the Air Survey Co., Ltd., had undertaken the survey of the coastal forests, an area of 400 square miles.

Work in Malaya was eventually increased with the result that this party returned there in the following season after a brief rest during the bad season when overhauls were carried out at the company's base at Rangoon. In the following season, in addition to numerous surveys of rubber estates, etc., the company made a large-scale photographic survey of George Town, Penang.

(To be continued.)

PRIVATE FLYING AND CLUB NEWS

THE YORKSHIRE AEROPLANE CLUB, which has now gone over to the N.F.S. organisation, put up a fine record last year, and their flying time amounted to 1,125 hrs. 25 mins., which was made up with 422 hrs. 25 mins. instruction, 130 hrs. 55 mins. solo instruction, 517 hrs. 55 mins. solo by "A" pilots, and 54 hrs. 10 mins. testing and joy-riding. Nineteen pupils qualified for their "A" licences.

PHILLIPS AND POWIS, of Reading, have reduced their charges for flying instruction to £2 an hour, and pupils are able to purchase a book of flight vouchers enabling them to have twelve 15-min. flights for £6. For short flights and trial lessons, 11s. for 15 mins. is charged. A point worth noting in connection with the school is that no entrance fee or subscription is charged.

Mr. E. C. Brown demonstrating the Coupe Moth belonging to the Chairman of W. B. Dick and Co. (FLIGHT *Photo.*)

THE DE HAVILLAND AIRCRAFT CO., LTD., have provided an opportunity for technical tuition in aeronautical engineering.

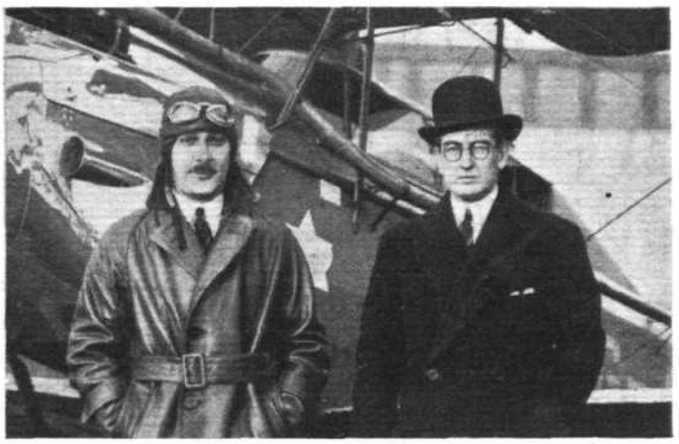
Day and evening classes are held at Stag Lane, the evening classes falling under the jurisdiction of the Board of Education and the Middlesex Education Committee. The lecturers who conduct the evening classes are men who actually carry out the work they teach, in their everyday life, in this respect differing from many teachers who are not practical men.

In December last an examination was held at Stag Lane by A.M. officials, at which 16 candidates were examined for A.M. Ground Engineer's licences, all of whom passed.

THE AMERICAN CIRRUS MARK III engine, built under licence in America by American Cirrus Engines, Inc., of Marysville, Michigan, has been obtaining excellent results, and in the Miami-Cleveland Air Derby, two standard Great Lakes Trainers, fitted with American Cirrus Mark III engines, one of which carried, in addition to the pilot, a mechanic and 75 lbs. of luggage, finished second and fourth, after a flight of 1,483 miles at full throttle.

A Great Lakes Sports Trainer, fitted with the American Cirrus Mark III engine, piloted by Tex Rankin, recently flew non stop from Vancouver, over the United States to Agua Caliente, Mexico, in 13 hrs. 7 mins., using only 75 U.S. gallons of petrol, an average of 18 miles per gallon of petrol, at a speed of over 100 miles per hour. This pilot is also credited with 19 outside loops on a similar machine at Portland, Oregon, on January 7 last.

ANOTHER firm to see the value of aircraft to their business is W. B. Dick & Co., of Grosvenor Gardens, whose chairman has just bought a Coupé Gipsy Moth, which will

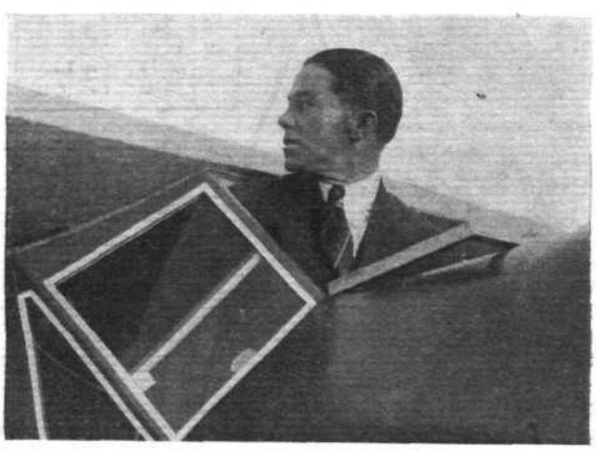


Mr. E. C. Brown and Mr. A. Franks, Managing Directors of W. B. Dick and Co. (FLIGHT *Photo.*)

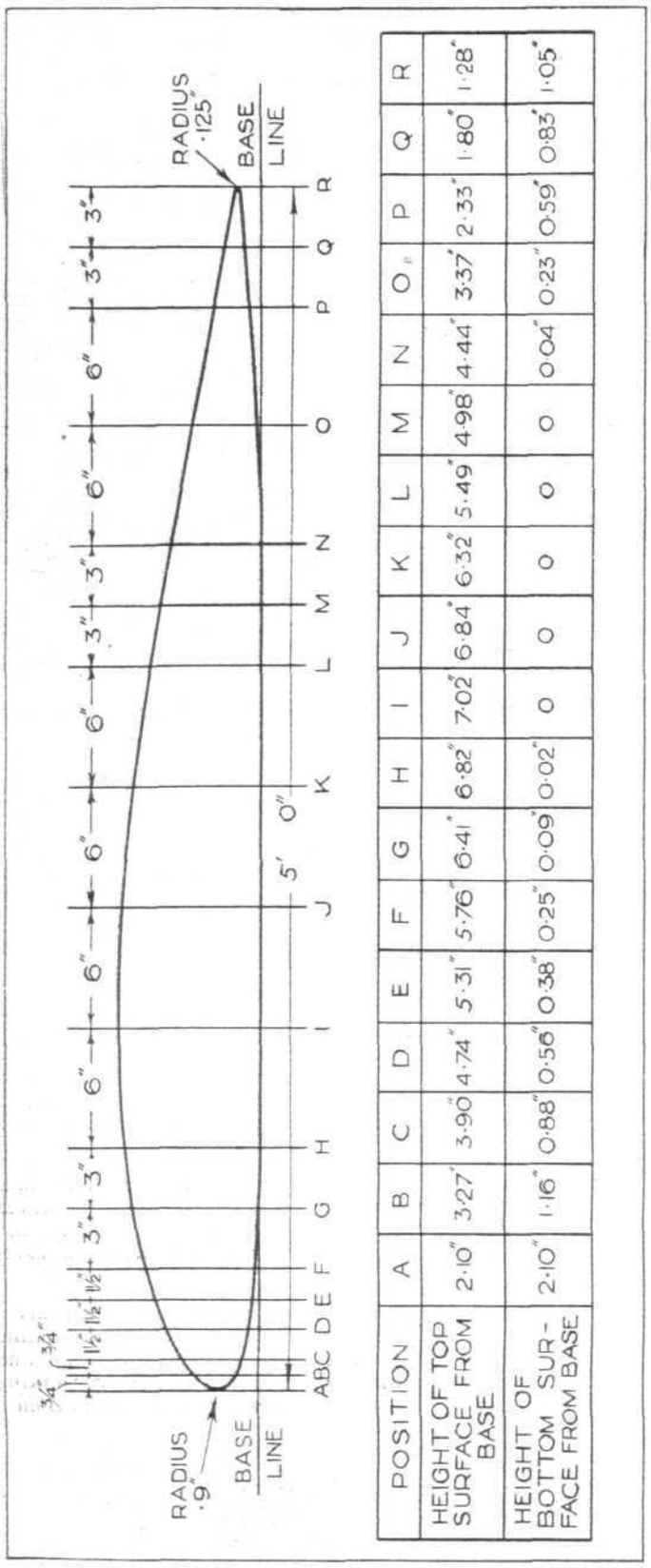
be flown by Mr. E. C. Brown, and we expect to see him at the flying meetings which are shortly beginning again. This firm is one of the oldest in the lubricating oil business and have for many years acted as refiners to some of the best-known lubricating oil companies, besides supplying lubricating oil to all Government Departments. Now they are going to market their own aero engine oil under the name of "Ilo," and the Moth will be used for a practical test of some 100 hrs. flying. Both a mineral and castor oil will be marketed, but the former, in common with the growing tendency, will be the one generally advised for the use of private owners under normal conditions. Oils suitable for lubricating aero engines have, of course, been marketed in the past, but a somewhat extensive campaign is now being initiated and the purchase of this Moth is a part of this campaign, and as the engine will be run entirely on their own oil, its behaviour should prove a very good selling point.

THE BRITISH GLIDING ASSOCIATION will hold their inaugural meeting in the lecture hall of the Royal Society of Arts, 18, John Street, Adelphi, W.C.2, at 6.30 p.m., on Thursday, March 27. The President, Sir Sefton Brancker, will take the chair.

A NEW IMPROVEMENT which has recently been incorporated in the latest Desoutter machines is a folding front windscreen. This allows the pilot to stand up and look round over the wing behind the machine before taking off. This should prove very useful on crowded aerodromes,



and does away with the point so often criticised on high-wing monoplanes. Another alteration is that the pilot's seat has been made in bucket form and padded, the same as the new type of passengers' seats, which should greatly add to the pilot's comfort.



POSITION	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
HEIGHT OF TOP SURFACE FROM BASE	2·10"	3·27"	3·90"	4·74"	5·31"	5·76"	6·41"	6·82"	7·02"	6·84"	6·32"	5·49"	4·98"	4·44"	3·37"	2·33"	1·80"	1·28"
HEIGHT OF BOTTOM SURFACE FROM BASE	2·10"	1·16"	0·88"	0·56"	0·38"	0·25"	0·09"	0·02"	0	0	0	0	0	0·04"	0·23"	0·59"	0·83"	1·05"

ABOVE we give the ordinates of the C.Y.H. aerofoil section laid out on a 5-ft. chord, so that those who are constructing the Dickson Glider, will have no difficulty in making up the ribs together with this and last week's drawings.

The factors which have been adhered to in the design of this glider are actually somewhat higher than those suggested by the Gliding Association, so constructors need have no fear on the score of strength. A somewhat piquant situation is now possible as the R.A.E. state that there are no official requirements for gliders and no C. of A. is required, but we are discussing this elsewhere in this issue, as the importance of having this point made quite clear can hardly be over-estimated.

Many enquiries have been received about this glider, and we shall be glad to hear of any difficulties readers may have in its construction.

BELOW we give the conclusion of Mr. Alan Goodfellow's observations on the light aeroplane club situation.

In last week's issue some account was given of the activities of the State-aided light aeroplane clubs, both in this country and in the Dominions. In this issue it is proposed to discuss the future of the associated clubs and their relationship with other flying organisations.

The associated light aeroplane clubs are asking for, and claiming to be entitled to, a continuation of the State assistance already afforded to them. It is convenient therefore to consider the arguments which might be set up in opposition to their claim. These may roughly be divided under the following heads :—

(*a*) That they are not carrying out the work for which they were created.

This is not very likely to be raised. The statistics already quoted and the public recognition accorded to their work by those in authority would give the lie to any such suggestion before it was made.

(*b*) That other organisations have come into existence which can carry out the work of the light aeroplane clubs more cheaply and more efficiently.

The only organisation so far as one is aware that could claim to be considered in this respect is National Flying Services, Ltd. . This organisation has issued a prospectus foreshadowing the formation of light aeroplane clubs in various parts of the country which are to offer flying facilities to members at terms not very much higher than those of the associated clubs and with the aid of a much smaller Government grant. Without in any way decrying the activities of this concern, which deserves our best wishes in many respects, it is far too early as yet to say whether they will be able to carry out their intentions. The estimates given by N.F.S. for club flying vary so greatly from the figures which our combined experience has provided, that we are entitled to view them with doubt for the present. It will be time enough to see whether they are justified when N.F.S. have been going several years and are faced with the problem of renewing worn-out machines, etc. In any case, purely as a personal view, one believes that clubs should be run by and for the members (subject to a reasonable amount of " benevolent despotism " if you can find the right man), and that no commercial concern can hope to run a real club, for the simple reason that a real club is not a commercial proposition. For the same reason, one holds that the clubs should not only steer clear of commercial flying themselves, but should also, wherever possible, encourage joy-ride and air-taxi concerns, etc., to come and settle down alongside them, free from competition.

(*c*) That the work done by the clubs has ceased to be of sufficient importance to justify State assistance.

We are open to conviction, but it does seem clear if one faces the facts, that the work of the light aeroplane clubs is not only of greater importance now than ever before, but is likely to become even more important during the next five years. The time will come when commercial air transport will be able to justify itself in this country, but that time is not yet here, and if we are to make progress during the next five years, by far the simplest way of doing it is by encouraging the growth of private and club flying. The only alternatives are to pay colossal subsidies to commercial air transport concerns which even then may not be able to make good, or to retire altogether from the field and leave our aircraft industry to concentrate on service types and abandon the potential world market to subsidised foreigners.

(*d*) That the present support was given only upon the basis that the clubs would or should be self-supporting at the end of the agreement period.

The answer to this last point raises an interesting issue and in it really lies the crux of the whole position. When the present agreements were entered into the stipulation that State assistance should cease at the end of three years was admittedly based on the supposition that by that time the cost of club flying would have fallen to such an extent as to make the clubs self-supporting. This argument, sound though it appeared at the time, has proved completely fallacious. Three to five years ago the light aeroplane clubs were being in effect subsidised by nearly every commercial concern connected with aviation, because these concerns realised the importance of getting the light aeroplane club movement started. To take concrete examples, the manufacturers were selling their machines quite definitely below cost price, and were providing maintenance and repairs on a very generous basis. To-day, although the quality of the machines has vastly improved, the prices are little lower, while the cost of repairs, maintenance, etc., is (in our experience at any rate) definitely higher than was the case five

years ago. It is not that the manufacturers are profiteering in any way, but simply that they are getting on to an economic basis. Similarly, aerodrome tenancies were fixed up on a sliding scale basis in the belief that the clubs would be able to pay more as they became more firmly established. To take our own case, we started at £50, whereas, to-day, we are paying in rent and rates nearly £150 per year. What is true of the manufacturers and aerodrome owners is equally true of the B.A.I.G., which during our earlier years undoubtedly subsidised most of us by uneconomic premium rates. For several years past our insurance expenditure has been a steadily increasing item and even now it cannot be said that the B.A.I.G. is making any excessive profit out of us!

It might be thought that increased membership and consequently increased subscription income would cover such items, but experience shows that increased membership also brings increased secretarial work, some of which, at any rate, has to be paid for. Again, it might be thought that increased flying hours would more than compensate for the increased repair and maintenance charges. This is true up to a point, but there is one factor which, unfortunately, cannot be overlooked. We are using to-day, engines of 50 per cent. greater power than was the case five years ago, which means an increase in petrol consumption, one of the main items in our expenditure accounts. As everybody knows, the cost of petrol has, unfortunately, not come down during the last two and a half years, but has, on the contrary, soared upwards!

Thus we see that through no fault of their own the clubs are actually in most cases on at least as high rate of expenditure now as was the case five, or even three, years ago. We have all tried hard to build up reserve funds during the past two or three years. The best that most of us have accomplished has been the reduction or wiping out of the losses incurred under the original scheme. It is not yet possible for any of them to provide "cheap flying for the multitude" without State assistance. True a number of unsubsidised clubs have been started in England, but can it be said of any of them, offering the same facilities as the associated clubs, that it has proved a subsidy to be unnecessary? We think not. Given an aeroplane or so to start with any club can carry on for a limited period but it cannot under present conditions continue its existence for long without extra support either from wealthy members or from the State.

This brings us to the last point—what will happen to the clubs if the State withdraws support? Some perhaps will close down, or perhaps be taken over by N.F.S. Others (among which one hopes we shall be counted) will carry on as best they can with increased subscriptions and flying rates. The traditions built up, the voluntary work put into the organisation of many of the clubs, are too good to be scrapped and wasted. Even so, the position would be something of a tragedy. Our membership, instead of embracing hundreds of people drawn from all ranks, would dwindle to a mere handful of those well endowed with leisure and money. With this would come a tremendous decrease in the influence we can and are exerting towards the spread of airmindedness.

The clubs are the children of the Government. Some of them, no doubt, are better than others, but they are all good children as children go, and full of promise for the future. During their minority they have been paid an allowance and it is our contention that the time for its discontinuance has not yet arrived. But even so, if the time has in truth come for us to "paddle our own canoes," surely it is not the part of a wise parent, having spent money on our upbringing, to push us out into the world with little or no hope of making good. At the worst, if our allowance must indeed cease, one suggests that the Government should present to each club as it "comes of age" (*i.e.*, as its agreement expires) a cheque for £10,000 as working capital or reserve together with its blessings and farewell. With such a start we might ultimately hope to succeed, though for some years to come at any rate, we should be back to the early struggling period. Nevertheless, a substantial invested reserve is a wonderful incentive to "keep on keeping on," especially when a sense of filial duty also urges in the same direction.

There *is* a responsibility on the State, which has brought us into being and accepted our loyalty and service. It would be to the lasting discredit of the State if that responsibility were evaded or ignored.

MOTH Owners who are travelling in Germany and who land at Tempelhof Aerodrome should remember that Herr Friedrich has established there a well equipped Moth Service Station and is able to quote reasonable prices for all repairs and carries a full stock of spares of every description.

Apparently owners have forgotten that this service station exists and when at Tempelhof have been directed to other quarters where they have not been able to get properly skilled Moth or Gipsy mechanics or to obtain spares. Herr Friedrich's Service Station is not far from the Lufthansa premises and is clearly labelled.

THIS week we are able to publish the replies which Capt. N. Stack, of N.F.S., has written to the questions raised by "J. J." in last week's issue. As Capt. Stack points out it is well nigh impossible for anyone however experienced to lay down the law and do this or do that under certain circumstances, because each case must be decided on its merits and the only possible judge is the pilot on the spot at the moment. Capt. Stack says :—

"In reply to question 1. In my opinion the best material for wind sleeves is Irish linen. The size for all general purposes about 8 ft. in length, about 2 ft. diameter at the mouth and about 10 in. diameter at the trailing end. With regard to their being a nuisance during gales, it is very difficult to suggest what sort of material to use in order to combat the gale, as even sail cloth can be ripped to ribbons providing the gale is strong enough.

"With regard to landing up a hill, it is a little difficult to advise on this matter as the landing must largely be governed by many things, such as surrounding obstructions, trees, shape of field, direction of wind, etc. This problem usually can only be solved by the pilot on the spot from his knowledge and experience of flying. However, I would advise when landing up a hill to make a perfectly normal landing up the hill providing it is into wind, and before the momentum has been run off turn at right angles to the direction of landing in order that the machine will not commence to run backwards down the hill after coming to a standstill. On the other hand, it may be possible to land across the slope of the hill. I do not advise under any circumstances anding down a steep hill as the aeroplane would get out of control and probably continue running down the slope into the boundary or whatever obstruction happens to be at the bottom. With regard to taking off down hill, this ought to present no difficulties as it is usually easier to take off down hill than up, providing it is into wind, as the slope of the hill helps in the acceleration of the machine over the ground. As a rule it is best to land up hill and take off down hill, conditions being favourable, but as I have remarked previously the only person to judge satisfactorily is the pilot on the spot, who can see for himself the shape, and size of the aerodrome, and the obstacles to be cleared.

"I suggest that a good book to be read on aerial navigation is 'Primer of Air Navigation,' by H. E. Wimperis, price 8*s*. 6*d*. (Edward Stanford & Co.).

"With regard to landing on and refuelling at Royal Air Force aerodromes, providing it is not an experimental aerodrome which is usually on the secret list, one is permitted to land on Royal Air Force Aerodromes in Great Britain. The circuit rules must be adhered to. A flag usually indicates what circuit is to be made. A red flag indicates left-hand circuits and a green flag indicates right-hand circuits. In the event of no circuit flag being shown, the pilot should make a right-hand circuit. Upon landing pilots should taxi over to the hangars, keeping clear of any other machines landing, and report to the Pilot's Office or to the Officer of the Watch. The Officer of the Watch or the Orderly Officer will then tend to the needs of the visiting pilot. Petrol and oil will be supplied, for which the pilot will have to sign and pay for. A landing fee also has to be paid and if the machine is hangared for the night housing fee has also to be paid. As a rule very good assistance and hospitality is offered to one on landing on Service aerodromes."

THE de Havilland Aircraft Company, Limited, received a cable at 10 a.m. the other day from its representative at Buenos Aires requesting a quotation and shortest time for delivery for a specially equipped Gipsy Moth, required in the greatest hurry for a customer. Price and delivery date were immediately quoted in a return cable, the reply to which, accepting terms, reached this office at 3 p.m. on the same day. A speed record?

The order for a Gipsy Moth christened "Gavilan de Oro" from Shell-Mex, Ltd., for the use of their Buenos Aires representative has been followed by further orders for Moths for their Indian and South African branches. The gold-and-red Moth, owned by the London Head Office and flown by Captain H. Shaw, is a familiar sight at British aerodromes, on each one of which he must have landed at one time and another in the course of his numerous business trips.

AIRISMS FROM THE FOUR WINDS

Mr. Chichester Nearing Home

MR. F. C. CHICHESTER, the New Zealand pilot, who set out from Croydon on a lone flight to Australia and New Zealand, on December 20, in a D.H. Gipsy Moth, has been making good progress since his mishap at Tripoli, the day after he started. He was delayed some time at Tripoli, but resuming eventually, he flew by way of Aboukir (where his brother is in charge of the petrol station), Bushire and Charbar to Karachi, where he arrived on January 14. Continuing, he reached Calcutta, on January 16, Rangoon on January 17, and Singapore on January 18. The engine was overhauled at Calcutta, and at Singapore he received a hearty reception from the R.A.F. Batavia was reached on January 20, and after another day looking over the engine, he proceeded via Sourabaya to Atambau. From here he flew straight to Port Darwin, where he arrived on January 25, and continuing the following day, he arrived at Camooweal, after several delays *en route*, resulting in his being reported as "missing" for several hours. Mr. Scullin, Prime Minister of Australia, sent a message of congratulation to Mr. Chichester. It may be of interest to note that Mr. Chichester learnt to fly at the Brooklands School of Flying.

Somewhat Confused

BY some peculiar freak of the brain, we last week not only changed the nationality of Sir Ahmed Hassanein Bey from Egyptian to Indian, but diverted his solo flight from Egypt to India! By our caption, "Indian Flight to India," we were thinking of Mohan Singh's flight, which is reported below. Sir Ahmed Hassanein Bey has again met with misfortune. He got as far as Pisa, on January 28, but on landing the machine overturned and was damaged—its pilot, however, escaped unhurt.

Mohan Singh Starts Afresh

MOHAN SINGH, the Indian airman, who is attempting to win the Aga Khan Prize for a flight to India and damaged his D.H. Gipsy Moth in a forced landing near Noyon, flew from Le Bourget back to Lympne, on January 25. The same day he made a fresh start for India, and arrived safely at Le Bourget that evening.

French Flight to Indo-China

ON January 17 two French airmen, Commandants Weiss and Girier, left Istres on a flight by stages to Pondicherry, and reached Tunis that afternoon. On January 19, they arrived at Aboukir and resumed their flight the next day to Baghdad, and finally reached Pondicherry on January 28. They are flying a Breguet fitted with a 600 h.p. Hispano-Suiza engine.

R.A.F. Flight to the Cape

THE four R.A.F. Fairey 3F aeroplanes of No. 14 Bomber Squadron, which are flying from Cairo to Cape Town and back, reached Bulawayo on January 25, and Pretoria on January 27. At Buluwayo, Air Commodore Board, one of the pilots, was injured in a motor-car collision.

Egyptian Flies from Germany to Cairo

MAHMOND SIDKY EFFENDI is the first Egyptian to fly from Europe to Egypt. He left Berlin in a 40-h.p. light aeroplane last December, and flew in easy stages to Cairo, where he arrived on January 26. He received an enthusiastic reception from thousands of his fellow-countrymen, who flocked to the R.A.F. aerodrome to see him land. He wins a prize of £500 by his flight.

Graf Zeppelin to Make a Flight to South America

PREPARATIONS have been made for a flight early next May by the *Graf Zeppelin* to South America, via Seville, where a halt will be made to pick up passengers.

"Youth of Britain" Damaged

THE D.H. "Giant Moth," *Youth of Britain*, which Sir Alan Cobham flew out to Rhodesia in connection with Imperial Airways Cape to Cairo air route survey, crashed at Broken Hill, on January 19. Capt. Wooley Dod, the pilot escaped injury, but a passenger and two mechanics were slightly hurt.

A Light 'Plane Record by Italy

ON January 20, the Italian airman, Donati, beat the distance record over a closed circuit for light 'planes by accomplishing a flight in a Fiat A.51 (85 h.p. Fiat) of 2,800 kms. (1,750 miles) in 29 hrs. 3 mins. 9 secs.

Luncheon to Lord Thomson

ON February 7 a luncheon will be given to Lord Thomson, Secretary of State for Air, by the British Empire League, at the British Empire Club, 12, St. James's Square, S.W., at 1.15 p.m. (for 1.30 p.m.). The Right Hon. Lord Southborough will preside, and Lord Thomson will speak on "Aviation and the British Empire."

Eielson's Aeroplane Found

Two airmen, named Joe Crosson and Harold Gillam, have found the wreck of the aeroplane in which Lieut. Ben Eielson and Earl Borland disappeared on November 9, 1929. The lost men were carrying supplies from Teller in Alaska to a motor ship which was icebound off Cape North. The wreckage was found some 10 miles inland from the mouth of the Auguem river in Siberia. The machine had been completely wrecked and the engine was lying 30 yards away from the remains of the fuselage. Crosson and Gillam are convinced that the bodies of Eielson and Borland will be found buried in the snow nearby. They returned to the nearest post for help, and dog teams as well as aeroplanes set off again for the spot. Ben Eielson piloted Sir Hubert Wilkins on his flight across the Arctic ocean from Alaska to Spitzbergen. He was also with Sir Hubert when he visited England and was entertained by the aeronautical bodies in London. In one speech Lieut. Eielson advised us British to be less modest in honouring our great airmen, such as Sir John Alcock and Sir Arthur Whitten-Brown. Sir Hubert Wilkins described Eielson as "a perfect pilot."

Sqdn.-Ldr. Orlebar

SQDN.-LDR. A. H. ORLEBAR, A.F.C., *p.s.a.*, who, together with Flight-Lieut. G. H. Stainforth, has remained on the High-Speed Flight since the completion of the record flying, has now been appointed to command the Flying Boat Development Flight of the Marine Aircraft Experimental Establishment at Felixstowe, in succession to Sqdn.-Ldr. C. L. Scott, D.S.C. Before he was posted to command the High-Speed Flight about a year ago, Sqdn.-Ldr. Orlebar had had, we believe, no experience of flying seaplanes—and racing seaplanes are a very specialised form of marine aircraft. Flying boats are quite a different proposition, and call for a high degree of seamanship. However, during the Schneider training this expert pilot certainly learned a lot about tides and sea currents, and his all-round capacity is so great that we feel sure of his making a success of the very interesting and important command with which he is now entrusted.

The Lake Garda Tragedy

THE seaplane in which Maresciallo T. Dal Molin was killed has now been brought to the surface of Lake Garda. The pilot's body was not in the seat and the safety belt was unfastened. This suggests that Dal Molin had had time to realise his danger and tried to free himself. It is not yet known if the condition of the machine or engine throws any light on the cause of the crash. The lake is 500 ft. deep at this point, but it is still hoped that the body of the pilot will be recovered.

An Error Perpetuated

PROBABLY no fear haunts the conscientious journalist more than that of making a mistake. It is not only the effect of the original error, but the possibility, or even probability, that the error will inadvertently be perpetuated which makes it so essential that mistakes should be avoided at all costs. We have had an example of this fact recently, in connection with Lodge plugs. In our issue of September 13, 1929, on p. 995, the statement was made that a sparking plug in Waghorn's engine had broken up, and that the cylinder was badly scored. It was afterwards pointed out to us that this was not the case, but that, on the contrary, the Lodge plug was actually instrumental in disclosing a cylinder defect. A correction to this effect was published in our issue of September 20, 1929, on p. 1028. *In point of fact, it is historically worthy of note that the Lodge plugs operated perfectly both during the Schneider navigability trials and in the actual contest.* In last week's issue, in the article on "Dal Molin" on p. 146, the original erroneous statement concerning the plug in Waghorn's engine was repeated by a member of the staff, who, in referring back to the original Schneider Trophy article, was not aware of the error of it, not having been on the staff of FLIGHT in September last. We repeat that the Lodge plugs were not to blame and gave no trouble of any kind, and we offer our sincere apologies to Lodge Plugs, Ltd., for inadvertently perpetuating an erroneous statement which had already previously been corrected.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

January 31, 1930

CONTENTS

THE ESTIMATION OF NO-LIFT CHARACTERISTICS

(With a Discussion of the Results of the Tunnel Tests on the M1 to M27 Series)

By W. R. ANDREWS, Higher National Diploma (Hons.)

(*Concluded from page* 95)

Mr. Andrews, of the Technical Staff of A. V. Roe & Co., this month brings to a close his article on no-lift characteristics. He arrives at the conclusion that the results of model tests in the American variable-density tunnel, although invaluable as far as lift and drag are concerned, may be subject to errors in the matter of moment coefficients.

It has previously been pointed out that the relationship of Fig. 1 refers only to aerofoils having the centreline convex upwards over the entire chord.

A discussion of the results of the tests on R.A.F. 33 and 34 will now be of interest.

Both R.A.F. 33 and 34 have the centreline curved in the form of

$$y_o = ax\,(1 - x)\,(0{\cdot}875 - x)$$

This curve is designed to give zero moment at no-lift.

The maximum camber of R.A.F. 33 is 0·05 and that of R.A.F. 34 is 0·02.

Whereas in a non-reflexed section, the calculated value of Km_o is too negative, that for the reflexed sections R.A.F. 33 and 34 is too positive, as shown by the Table 2.

Table 2

Section.	Km_o Calc.	Km_o Obs.	ΔK_m
R.A.F. 33 0·05	0	− 0·009	− 0·009
R.A.F. 34 0·02	0	− 0·004	− 0·004

The actual value of K_{mo} increases with the increase in camber, which is what is to be expected and is suggested by the theory.

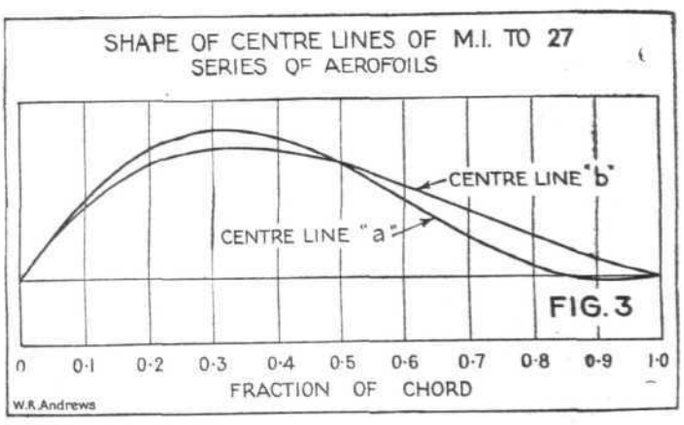
This result is of great importance in connection with the following discussion of the results of the wind tunnel tests on the M1 to 27 Series of Aerofoils (N.A.C.A. Report No. 221. "Model Tests with a Systematic Series of 27 Wing Sections at full Reynolds number").

The M1 to 27 Series are built up from two basic centreline forms and three streamline profiles which are draped around the centrelines.

Various combinations of centreline shapes are obtained by the addition and multiplication of the ordinates of the basic centrelines.

Each centreline combination is tested with each of the three streamline profiles draped round it in turn. Thus M4, 5 and 6 have the same centreline with different drapings, M7, 8 and 9 have centrelines having ordinates of twice the value of M4, 5 and 6. M 13, 14 and 15 have centrelines which are the sum of the two basic centrelines and so on, each set having the profiles of M 1, 2 and 3 draped round the common centreline.

For the purpose of this investigation only the combinations draped with the thickest streamlined profile (M3) will be considered, the thickness to chord ratio being 0·12 as against 0·127 for the R.A.F. 30-34 series.



The centrelines are called "a" and "b" to distinguish them and are plotted on a foreshortened base in Fig. 3.

The centreline "a" is reflexed similar to R.A.F. 33 and 34, except that the ordinates fall to zero at about 0·85 the chord instead of 0·875 in the case of R.A.F. 33 and 34.

The centreline seems to follow the law

$$y_o = h\,(1 - x)\,(a - x)$$
$$= 0{\cdot}2x\,(1 - x)\,(0{\cdot}85 - x) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

and by the method of R. & M. 910, the no-lift conditions are :

$$K_{mo} = \frac{\pi}{64} h\,(7\text{-}8a)$$

$$= \frac{\pi}{64} \times 0\cdot2\,(7 - 8 \times 0\cdot85)$$

$$= \underline{+\,0\cdot017}$$

$$\alpha^{\circ} = \frac{h}{8}(4a - 3)$$

$$= \frac{0\cdot2}{8}(4 \times 0\cdot85 - 3)$$

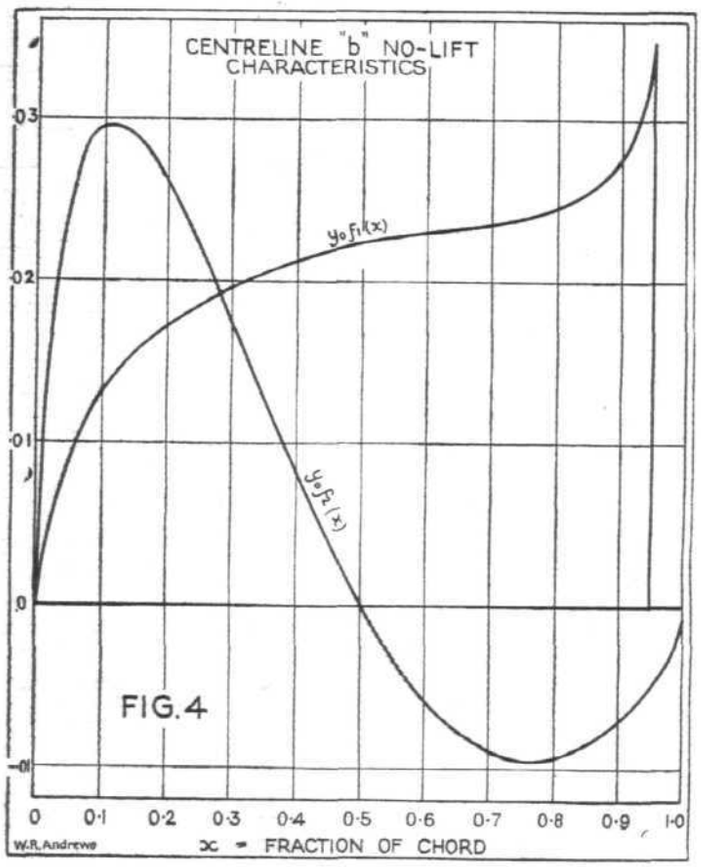
$$= 0\cdot01 \text{ Rads.} = \underline{0\cdot6^{0}}$$

The law of centreline " b " seems to be

$$y_o = 0\cdot05x\,(1 - x)\,(1\cdot68 - x)^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The complete working for the computation of α_o and Km_o are given in Table 3 and Fig. 4, their values being :—

$$\alpha_o = -1\cdot29^{\circ} \qquad Km_o = -0\cdot012.$$



Centreline " b " is roughly a mean between the flat undersurface sections and R.A.F. 33 and 34. Since $\Delta\ Km$ varies from positive to an almost equal amount negative when the centreline is reflexed as in R.A.F. 33 or 34, the actual value of Km_o for Section " b " should be very close to the calculated.

We have previously satisfied ourselves that by keeping the same shape of centreline, the value of Km_o will be roughly proportional to the value of the maximum camber.

All the results previously investigated have had the moment measured about the leading edge of the model. The tests on the M1 to 27 Series were made in the variable density tunnel and Km was measured about a point situated at 0·25 chord back from the leading edge.

The moments at no-lift as given by the tests are arranged in Table 3 so that the difference between the centrelines on the left and the right is either once " a " or once " b," the change in Km_o due to the addition of " a " or " b " being given in the last column.

If the evidence of Fig. 1 is to be relied on, the rate of change of Km_o from one camber to the next, should slightly decrease as the camber is increased.

Table 3

The No-Lift Characteristics of Centreline " b " by Method of R. & M. 910

x	y_o	$f_1(x)$	$f_2(x)$	$y_o f_1(x)$	$y_o f_2(x)$
0	0				
0·0125	0·0015	2·9	8·78	0·00435	0·01317
0·025	0·0031	2·09	6·10	0·00648	0·0189
0·050	0·0061	1·54	4·13	0·0094	0·0252
0·10	0·0111	1·18	2·67	0·0131	0·02965
0·20	0·0173	1·0	1·5	0·0173	0·026
0·30	0·0199	1·99	0·87	0·0197	0·01731
0·40	0·0196	1·08	0·41	0·0212	0·00804
0·50	0·0176	1·27	0	0·0224	0
0·60	0·0142	1·62	−0·41	0·023	−0·00582
0·70	0·0102	2·31	−0·87	0·0236	−0·00887
0·80	0·0062	3·98	1·5	0·0247	−0·0093
0·90	0·0026	10·6	−2·67	0·0276	−0·00695
0·95	0·0012	29·0	−4·13	0·0348	−0·00495

$$\text{No lift angle } \alpha_o = -\int_0^{1\cdot0} y_o f_1(x)dx$$

$$= -\,2\cdot9 \times y_o \text{ at } x = 0\cdot95 - \int_0^{\cdot95} y_o f_1(x)dx$$

$$= -\,2\cdot9 \times 0\cdot0012 - 0\cdot0191 \text{ Radians}$$

$$= -\,\underline{0\cdot02258 \text{ Radians} = -\,1\cdot29^{\circ}}$$

$$\text{Moment at no lift } Km_o = \int_0^{1\cdot0} y_o f_2(x)dx - \frac{\pi}{4}\alpha_o \text{ (radians)}$$

$$= 0\cdot00589 - \frac{\pi}{4} \times 0\cdot02258$$

$$= -\,0\cdot012 \text{ approximately.}$$

The last column of Table 4, however, shows that Km_o for this series follows no simple law but varies from −0·0135 to +0·0095 as centreline " a " is added to other sections.

A similar result is obtained with centreline " b " the value of Km_o varying from −0·022 to +0·008 with increasing camber.

The most striking results are those due to doubling the ordinates of section " a " or " b." The increase in Km_o apparently bears no relation to the Km_o measured on the original section.

These results are very inconsistent and if correct show that the Aerofoil Theory as applied to moments at no-lift needs revision.

No further evidence seems to be available to uphold the conclusions which might be drawn from the above.

If we take as a base R.A.F. 31 of maximum camber 0·02, and multiply the ordinates of the centreline by 2·5, the result is R.A.F. 32.

The value of Km_o has increased from −0·029 for R.A.F. 31 to −0·068 for R.A.F. 32, an increase of −0·039, which represents a Km_o due to the addition of 1½ times the centreline

Table 4

Profile.	Centreline.	Km_o.	Profile.	Centreline.	Km_o.	Centreline added.	Km_o due to added centreline.
M3	0	+0·007	M6	a	+0·006	a	−0·001
M6	a	+0·006	M9	$2a$	+0·006	a	0
M12	b	−0·0025	M15	$a+b$	−0·016	a	−0·0135
M15	$a+b$	−0·016	M18	$2a+b$	−0·0065	a	+0·0095
M21	$2b$	−0·0145	M24	$2b+a$	−0·008	a	+0·0065
M3	0	+0·007	M12	b	−0·0025	b	−0·0095
M12	b	−0·0025	M21	$2b$	−0·0145	b	−0·012
M6	a	+0·006	M15	$a+b$	−0·016	b	−0·022
M15	$a+b$	−0·016	M24	$a+2b$	−0·008	b	+0·008
M9	$2a$	+0·006	M18	$2a+b$	−0·0065	b	−0·0125

of R.A.F. 31 to the mother section. The average increase in Km_0 over this range is $-0{\cdot}039 \div 1\frac{1}{2} = -0{\cdot}026$ for each complete centreline added. This figure is of the same order as the Km_0 for the mother section, and is in keeping with the results to be expected if the Aerofoil Theory is accepted.

Numerous cases giving the same agreement with the predicted results could be obtained.

The results of the variable density wind tunnel are undoubtedly invaluable so far as lift and drag are concerned, but the foregoing analysis seems to suggest that the measurement or computation of the moment coefficients about quarter the chord is subject to certain errors.

Comparative results of tests on some of the M1 to 27 Series made in other wind tunnels, by their standard methods of measurement would, perhaps, supply certain evidence giving the amount of reliability to be placed in the results of the variable density tunnel, and also determine the exact cause of the discrepancies between the observed and calculated values, and the inconsistency of the observed values themselves.

LOAD FACTORS

By A. E. RUSSELL, B.Sc., A.M.I.A.E.

(*Concluded from page* 93)

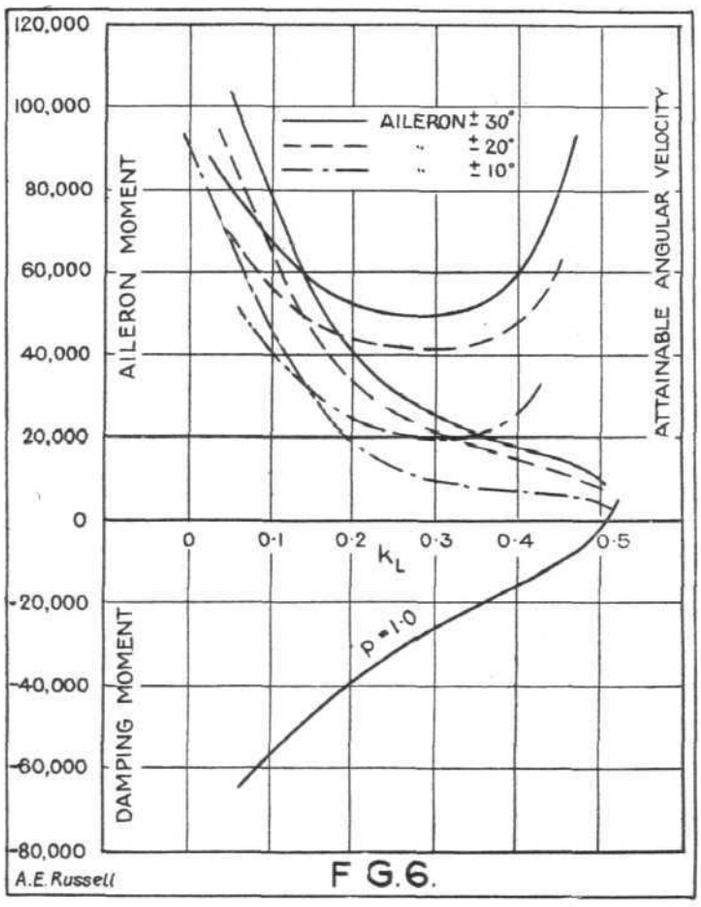
In the present issue we conclude the article on load factors, by Mr. Russell, who is head of the stress department of the Bristol company. It is regretted that it was found necessary to divide the article into several instalments, but the inconvenience caused to readers by having to turn up their back numbers is not very great, and we feel that the article is such a valuable contribution to the subject that those seriously interested will not mind.

Rolling

A roll is not easily completed at low angles of incidence where the damping moment is large. To complete a roll by the use of ailerons alone would take not less than 10 seconds, and as the direction of wing lift is varying at each instant with the angle turned through, the flight path would be a corkscrew. A roll may be more easily executed by first increasing the angle of incidence when the damping is small, or even negative, if the stall is passed, the roll can then be started by the use of rudder or ailerons ; the time may take now, only 3 to 6 seconds, and the more rapid change of direction of lift causes little departure from the initial course.

Considering the loads on the wings, we see why a roll is difficult to complete by the ailerons alone. Imagine an aircraft rotating instantaneously about a fixed axis relative to the wind, this inclination would be the angle of incidence with no rotation. Now consider one wing tip : this tip has a forward velocity due to the forward movement of the machine and a vertical relative velocity due to rotation. These two velocities may be added vectorially, and the resultant gives the nett angle of incidence at any position along the span. For the rising tip, the incidence is decreased, and for the falling tip increased. So long as the angle of incidence on the down-going tip remains below the stall, it is seen that the down-moving tip gives an increased lift, and the up-moving tip a decreased lift with a resultant rolling motion opposing the moment imposed by the controls. This damping becomes less effective as the incidence increases and as the stall is passed it rapidly drops and becomes negative. This condition of negative damping is called autorotation. If the reader is not familiar with the phenomena of autorotation, he cannot do better than read the article on "Spinning," by Lieut.-Col. J. D. Blyth, in the October, 1929, issue of the AIRCRAFT ENGINEER.

Before examining the loads produced by aileron movement, we must first consider how they are produced. The effect of ailerons is fundamentally to alter the centre line of the aerofoil, *i.e.*, to increase the camber for positive or down aileron, and to decrease or reverse the camber for negative aileron ; positive aileron produces a higher cambered section at an increased angle of incidence. Increased camber results in a lower value of the no-lift angle, or a bodily displacement of the lift coefficient curve on the incidence base, so we see that the increased camber, as well as the increased incidence, gives a higher value of lift over the portion of wing with positive aileron. The reverse holds true for negative aileron.



F G.6.

Generally manœuvres involving angular displacement about the longitudinal axis can roughly be divided into two stages, the first a short period of high angular acceleration directly proportional to the control movement and inversely proportional to the lateral moment of inertia, and the second, when the damping moment approximately balances the control moment, giving nearly constant angular velocity. It was found that with a certain training machine, in a pure aileron roll to attain a 60° bank at top speed, the period of angular acceleration lasted considerably less than 0·1 second, though in this case the angular velocity only rose to 0·35 rads./sec. A mathematical analysis showed that a highly manœuvrable two-seater in a banked turn showed a maximum rate of roll in just over 0·3 sec. ; tests have shown that it takes 0·2 sec. to apply maximum control load, so that while the control moment is growing the rate of roll is also growing, hence it is impossible to apply full control moment without the presence of a damping moment.

In considering stresses due to aileron loads we will only examine the stage of maximum angular acceleration, since at maximum angular velocity there is zero moment on the wings and the rate of roll is considerably lower than in auto-rotation. Fig. 6 shows rolling moments for various aileron settings and also damping moments for unit angular velocity. The values are for a machine of 4,000 lbs. weight. Since the damping moment increases with the rate of rotation, the angular velocity must have a limiting value, and this is given by the ratio of the aileron moment to damping moment for unit rate of rotation. The angular velocities attainable are also plotted on Fig. 6.

Using this curve, a simple step-by-step calculation shows the maximum net rolling moment on the wings. Since this calculation is only meant to show general conditions, we

will make one or two simplifying assumptions ; these are :— (1) The pilot applies full aileron at a uniform rate in 0·2 sec. (2) A lift coefficient of 0·1 is taken ; this approximately corresponds to top speed. (3) At this low k_L the rolling moment coefficient is constant throughout the range of angles of incidence produced by roll. (4) The lateral radius of gyration is taken as one-seventh the wing span, then the angular acceleration $\dot{\omega}$ is produced by the net rolling moment N.

$$\dot{\omega} = \frac{N.g\ 49}{W.\ (2s)^2} = \frac{N \times 32 \times 49}{4{,}000 \times (2 \times 20)^2}$$

$$= \frac{N}{4{,}000} \text{ (say)}$$

Calculation Table

Time, secs.	Aileron rolling moment.	Assumed nett rolling moment.	Angular acceleration rads./sec.²	Angular velocity rads/sec.	Damping moment.	Nett rolling moment.
0·0						
	6,800	6,000	1·5	0·015	820	5,980
0·02						
	18,500	15,000	3·7	0·067	3,700	14,800
0·04						
	32,000	23,000	5·6	0·160	8,800	23,200
0·06						
	43,000	27,300	6·8	0·284	15,600	27,400
0·08						
	53,000	29,600	7·4	0·426	23,400	29,600
0·10						
	61,000	29,400	7·3	0·573	31,400	29,600
0·12						
	67,000	27,600	6·9	0·715	39,300	27,700
0·14						
	71,000	24,500	6·1	0·845	46,400	24,600
0·16						
	74,000	21,400	5·3	0·959	52,700	21,300
0·18						
	76,000	17,900	4·5	1·057	58,100	17,900
0·20						
	76,000	13,600	3·4	1·136	62,400	13,600
0·22						
	.....					
0·32						
	76,000	1,900	0·5	1·347	74,100	1,900
0·34						

This calculation shows that in this case constant rotation is attained in about 0·35 sec., a figure agreeing with the previous calculations mentioned. Maximum nett rolling moment is reached after only 0·1 sec., and is only 40 per cent. the maximum aileron moment as measured in the wind tunnel with no rotation. Even this is not a " stressing " moment, since the wings form most of the lateral moment of inertia : inertia loads due to the angular acceleration must be subtracted from the aerodynamic loading ; this smooths out the span loading, and at the lift coefficient taken in these calculations the load factor could not exceed 3 even in rapidly pulling out of a terminal dive. After allowing for a backward movement of the centre of pressure, we have a case easily covered by the C.P. back calculations of normal flight. The normal use of aileron would be much less severe, since full aileron would not be applied suddenly at speeds anything like approaching top speed. The high angular acceleration is more distressing to the pilot than to the machine.

We will now see how rolling is likely to produce stresses of structural importance. In a normal roll the stick is first pulled back to produce the angle of incidence necessary for auto-rotation : if this is done suddenly the normal load factor depends on the initial speed, as in the pull-out. At this stage, however, the angular acceleration and velocity are small, so that variation in span loading is small. Auto-rotation may now be started by the rudder. By the time maximum angular acceleration is reached the normal load factor has fallen to approximately half its highest value, and at maximum angular velocity is still falling.

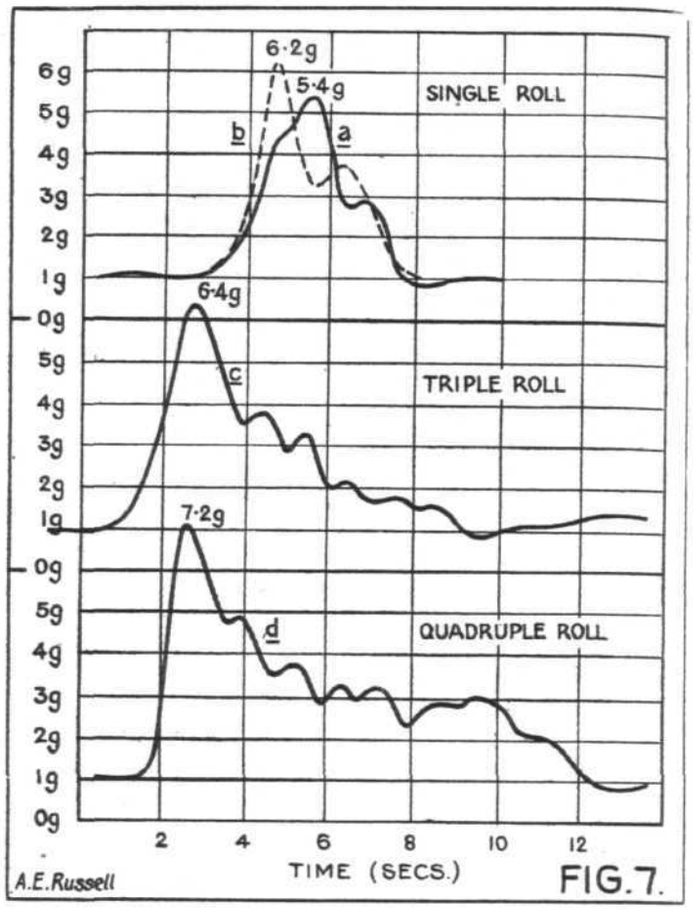


FIG. 7.

Fig. 7 shows values for normal accelerations in various rolls : the results are taken from Report No. 203 of the National Advisory Committee for Aeronautics of the United States. The machine used was a Fokker PW-7. Curve 1*a* is a single roll gently carried out, starting at a speed of 150 m.p.h. and finishing at 100 m.p.h. Curve 1*b* is a similar roll more violently carried out. Curve 2 is the record for a triple roll started at 150 m.p.h. Each roll shows two peaks of load factor, the first in each case being greater than the second. This is due to the drop in speed when inverted and the rise again in recovery. Final speed, 100 m.p.h.

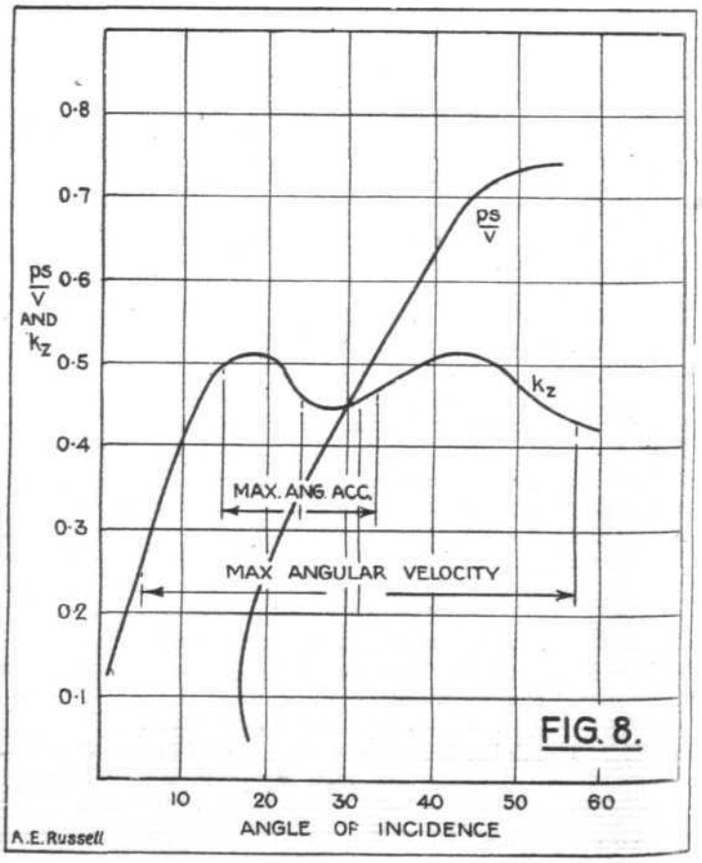


FIG. 8.

Curve 3 shows a quadruple roll started at 160 m.p.h. The stick was pulled back sharply, and the acceleration quickly rose to 7·2 g. That the speed did not fall off as quickly as might be expected is shown by the fact that the second, third, and fourth rolls all gave practically the same acceleration. It is seen that the time to complete the first roll is the longest and the fourth roll the next longest; this is due to the fact that this last roll was executed principally by the ailerons. It must be remembered that in these rolls the initial speed is higher than that of usual practice, and consequently the load factors are high. Engish experiments do not give maximum load factors exceeding 5·5 g.

The second stage of angular acceleration implies maximum rolling moment. An equation for the rolling moment can easily be found by integrating conditions along the span.

If p = rate of rotation in rads./sec.
y = distance along span.
s = semi-span.
k_z = the normal force coefficient.

Strictly, the force coefficient should be referred to the axes about which the machine is rotating, but only a small error is introduced by using the coefficient normal to the chord up to angles of incidence of 30° or more. Angle of incidence at any point y

$$\text{along the span } \alpha = \alpha_o \pm \tan^{-1}\frac{py}{V}$$

Normal force per unit of span

$$= k_z\rho c\,(V^2 + [py]^2)$$

$$\text{Rolling moment} = \int_{y=-s}^{y=+s} k_z\rho c\,(V^2 + [py]^2)\,ydy$$

$$= \int_{y=-s}^{y=+s} k_z\rho c V^2\left(1 + \left[\frac{py}{V}\right]^2\right)ydy$$

It is required to find when this is a maximum. There is no other way than calculating the rolling moment for various angles of incidence and values of $\frac{ps}{V}$. Calculations carried out in R. and M. 975 on a model Springbok showed that the rolling moment increases to a high value at 24° incidence and $\frac{ps}{V}$ of 0·16, and then falls off and does not again reach this first value until 38° incidence and $\frac{ps}{V} = 0{\cdot}60$. These latter values would not be attained in a roll at maximum acceleration, so that 24° incidence only is examined. A value of $\frac{ps}{V} = 0{\cdot}16$ corresponds to a change of incidence of ± 9·2° at the tips, *i.e.*, 14·8° on the up moving tip and 33·2° on the down moving tip. Referring to Fig. 8 it is seen that the variation in aerodynamic span loading is not alarming, and after the wing inertia loads have been added to the down moving wing and subtracted from the up moving tip, the loading is fairly constant along the span on the up moving wing, and slightly increased at the tip of the down-moving wing, so that we may come to the conclusion that in aileron and autorotative rolls angular acceleration is of small importance.

The stage of maximum angular velocity is more complicated. If we assume that a maximum rate of roll of 2·5 radians per second may be reached at a forward speed of 70 m.p.h. with a wing span of 40 feet, a value of $\frac{ps}{V} = 0{\cdot}48$ is obtained. From Fig. 8 this gives a mean incidence of 31° and tip incidences of 57° and 5°. The span loading in this case, we see, shows a hump about midway along the span and a falling off at the tips, more rapidly for the up-moving wing; the centre of pressure for the up-moving wing will be at its most forward position where the loading is highest, receding at the tip, where the incidence is low, and also at the centre, where the stall is passed. The C.P. movement and the fall off of loading at the tip decreases the bending moment at the outer support, giving less relief to the bay. The downward wing has an incidence beyond the stall everywhere, so that the C.P. is further back than the up moving wing, though not likely to exceed the position taken for the C.P. back normal flight calculations. This difference of C.P. sets up a wracking moment in the centre plane which is not provided for in standard calculations. I suggest that a criterion of strength for this would be given by stressing the centre plane with loads from one wing, as in C.P. forward, and the other wing, as in C.P. back, both, of course, at the same load factor, say 2·0; this would also allow for the yawing moment due to the difference of drag for the two wings, since at both C.P. back and at incidences beyond the stall the resultant force is approximately normal to the chord.

For the conditions of loading in the outer wings it is impossible to generalise, since the shape of the normal force coefficient below 30° incidence is entirely dependent on the aerofoil section chosen; from examples calculated it seems as if the minimum overall factor is likely to be of the same order as the C.P. back factor, but as the load factor is unlikely to exceed 2·0 at maximum angular velocity, an ample margin of safety is provided.

Spinning.

The essential motion in spinning is along a helical path, with continuous rotation about an axis inclined to the flight path, so when spinning to the right there is positive roll and positive yaw. Fundamentally the spin like the roll is autorotation; in fact, the roll is a horizontal spin; with a vertical spin, however, the rotation continues indefinitely, unless stopped by control loads. This is due to the gravity component acting along the line of flight. The angle of incidence is usually between the stalling angle and 40°, though it may reach 65° as in the flat spin, and herein lies a difference between the roll and the spin. When the inclination of the axes of rotation to the axes of machine exceeds 30° there is a large component of rolling moment in the $0z$ axis, *i.e.*, producing a yawing moment; now it is no longer sufficiently accurate to compute the rolling moment from the normal force coefficient. Since the elevators are not in themselves sufficiently powerful to produce these high angles of incidence there must be some additional moment in pitch. This is the inertia moment due to the rotation in yaw and roll, and is equal to

$$Q = (C - A)\,pr;$$

where
A = moment of inertia of machine about the longitudinal axis.
C = moment of inertia of machine about the vertical axis.
p = angular velocity in roll.
r = angular velocity in pitch.

If we again assume that the radius of gyration about the longitudinal axis is one-seventh the wing span, or, assuming an aspect ratio of 6, k_{ox} = six-seventh of chord.

$$\text{Then } A = \frac{W}{g}\left(\frac{6}{7}c\right)^2$$

$$\text{and } C = 2\,\frac{W}{g}\left(\frac{6c}{7}\right)^2 \text{ approximately.}$$

If $p = 1{\cdot}5$ rads./sec.
and $r = 1{\cdot}0$ rads./sec.

$$Q = \frac{W}{g}\left(\frac{6c}{7}\right)^2 \times 1{\cdot}5 \times 1{\cdot}0.$$

$$= 0{\cdot}034\ W\ c^2$$

which is equivalent to a backward movement of the C.G. of 0·34 chords. Thus it is seen that if the angle of incidence is allowed to grow to values much in excess of 30° the rotation in yaw produces a large moment, opposing the static stability and tending to increase the incidence. At angles of incidence of 60° to 70°, *i.e.*, in the flat spin, this moment may exceed the control moment, rendering recovery impossible. Fortunately only no-stagger, small gap biplanes will autorotate at these high angles of incidence, so this type is no longer used when prolonged spins are deemed necessary.

Since it takes four to five complete turns to develop a "flat" spin, a no-stagger biplane can be pulled out of an involuntary spin before the flat spin develops.

The difference between the loads on the structure produced in spinning and rolling is small. The incidence in the spin is possibly higher, but the value of $\frac{ps}{V}$ is likely to be of the same order so that the span loading will be approximately the same. The normal load factor varies from 1·8 for lightly loaded machines to 3 for highly loaded machines with a small span, hence the menace of the spin does not lie in the danger of structural failure but rather in the suddenness with which the motion may begin in an unintentional stall and the consequent height necessary for recovery. The rapid rotation makes it an unpleasant manœuvre and is heartily disliked by most pilots. It has a possible importance in military aircraft, but for civil and commercial flying a machine should be designed to be as difficult to spin as the usual compromises allow.

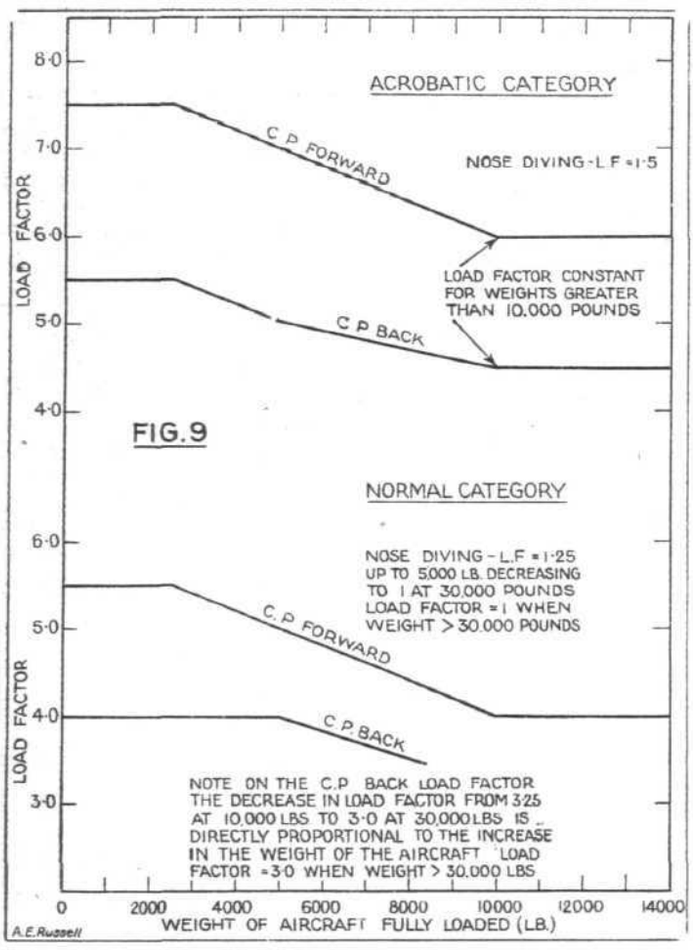


FIG. 9

We will now see what margin of strength, if any, aircraft designed to British standard strength requirements hold.

The requirements for flight loads are :—

(1) The strength of the main structure with the centre of pressure in its most forward position must have a factor not less than the value given in Fig. 9.

(2) The strength of the wings with the centre of pressure corresponding to top speed in horizontal flight must not be less than the appropriate value in Fig. 9.

(3) The strength of the main structure in a terminal nose dive must have a factor not less than 1·5 for the aerobatic category and 1·25 for normal category.

(4) The factor in inverted flying when required is usually two-thirds that required for C.P. forward normal flight.

The first thing that becomes obvious is that it is possible to break any machine in the air by rough handling. If we take the highest required factor for C.P. forward a machine weighing 2,500 lbs. need only be dived slightly in excess of 2·74 times its stalling speed and rapidly pulled out to reach the specified factor. The contention is, however, that the pilot forms his own accelerometer, and senses or "feels" when a manœuvre is being too rapidly executed. It is found by measured accelerometer tests that for civilian aerobatics the required factors include a factor of safety of approximately 2·0 ; accelerations of half the required factor produce angular velocities sufficiently high to produce the change of direction as rapidly as is normally required. For service aircraft, however, when rapid manœuvrability means life or death, a pilot does not want to be worried by the thoughts of structural failure ; it seems reasonable for single-seater fighters to be designed to the same ultimate acceleration that the pilot himself can withstand : this may mean a factor as high as 10. It is reasonable that the factors called in Case 2 and 4 should be in some proportion to Case 1.

In Case 2, the required factor is three-quarters that of Case 1, and appears on the whole to be rather high, though since it is only called for on the wings the small sacrifice in weight is amply repaid by increased stiffness. Also we saw that in inverted flight owing to the higher stalling speed, the decreased factor is justifiable. These three cases separately or combined cover all conditions of flight so long as the initial speed of the manœuvre does not exceed its predetermined value ; it should be noted that it is necessary to combine C.P. forward loads from one wing with C.P. back loads from the other wing to approximate to conditions in the roll or spin for the centre plane and centre section fuselage. The falling off of required factor with increase of weight is reasonable for civil aircraft since the heavier machines are usually designed for the specific purpose of carrying passengers or cargo and not for spectacular displays of aerobatics. The maximum acceleration encountered when flying in bumpy weather is rarely as high as 2·0, so that the minimum factor called for provides the usual factor of safety. For service aircraft the load factor should entirely depend on type and manœuvrability, and not on the weight. The nose diving factor called for is rather a mistake for machines exceeding 10,000 lbs., since with a machine this size the attitude is never attained : the height lost to reach the speed and recover is too great. Nose diving has not been considered in this article since it is steady and not accelerated flight.

AN ANALYTICAL REVIEW OF THE AERO ENGINE EXHIBITS AT OLYMPIA

By N. E. KEARLEY, A.M.I.E.E., A.M.I.A.E.

(*Continued from p.* 95.)

Cylinder Construction (*cont.*)

The last instalment of this review closed with an analysis of the various forms of cylinder construction to be found among the water-cooled engines at Olympia, the single block construction, and that in which separate cylinders are assembled to a common head, sharing the honours equally and also accounting for 89 per cent. of the total. Three engines only had a form of cylinder construction differing from the two main types, these three being the Sunbeam "Sikh III," the 18-cyl., broad-arrow type Lorraine (both these engines having their cylinders and heads forming separate units), and the 12-cyl., broad-arrow type Lorraine, in which the cylinders were grouped in pairs, each pair having a common water jacket. In passing, it is of interest to note that the latter engine and also the latest Lorraine water-cooled engine, the type 48·5, were the only foreign engines of the broad-arrow type having 12 cylinders only. The majority of the foreign firms appear to have been unable to resist the temptation to make a "six" of each bank of cylinders, a temptation which has so long been resisted by the British originators of the type. As the cylinder banks of all the 18-cyl., broad-arrow engines are, of course, set at 40 deg. to each other, these engines have a slight advantage over the 12-cyl., broad arrow type in the important matter of frontal area, whilst their length may be less, for a given output, than that of the more usual 12-cyl. V-type. Only one foreign six-in-line engine was shown, this being the little 100-h.p.

Hispano-Suiza light 'plane engine, one of the prettiest engines in the Show.

Perhaps the most interesting engine in the Show, from the point of view of cylinder arrangement, was the inverted 18-cyl., broad-arrow Farman, this being the only inverted water-cooled engine at Olympia. This arrangement has the obvious advantage of providing a high airscrew shaft position without interfering with the pilot's field of vision. It is, however, doubtful whether these advantages are not outweighed by the maintenance difficulties resulting from the inaccessibility of the components fitted between the cylinder banks. The arrangement would appear to be good from the point of view of cooling, as the water from the pump is fed direct to the hottest part of the jacket, whilst the water at the highest temperature circulates round what is normally the coolest part of the cylinder walls, thus tending to equalise the cylinder wall temperature. It may be recalled that Napier's produced an inverted "Lion" engine some years ago, but there does not appear to have been a demand for the type in this country.

Reverting to the matter of cylinder construction, the monobloc type could at one time have been sub-divided into two groups, depending on the provision of a "wet" or "dry" liner for the cylinder proper. With the recent change over of the Hispano-Suiza firm to the wet type, in which the cooling water is in direct contact with the cylinder barrels, the dry liner appears to have gone completely out of fashion, which is hardly surprising, for the only reason for its retention would appear to have been the difficulty encountered with the wet type in making a joint at the bottom of the block which would permit expansion and would at the same time remain watertight. As this problem has been solved in various ways by the different makers, the wet liner is now generally employed, although it may be remarked that the term "liner" in this instance is not quite appropriate.

The cylinder barrels of two foreign makers employing the monobloc construction are of special interest, namely, those of all Hispano-Suiza engines and of the new 660-h.p. Lorraine 12-cyl., broad-arrow type. The barrels of the latter are chromium-plated, whilst those of the patented Hispano-Suiza cylinders are surface hardened by a nitrogenating process known as "Nitriding" or "Niturizing." This process, which has come into considerable prominence recently (although it originated in Germany shortly after the war), has the merit of producing a hard skin equal to that provided by the more usual case-hardening process, but at the comparatively low temperature of 500° C. The resulting absence of distortion enables the surfaces to be treated to be finished before hardening. The Hispano-Suiza patents do not cover the actual hardening process, but its application to cylinder liners of an alloy steel known as Nitralloy, which is especially suitable for this form of heat treatment. The extension of the process to a number of other components such as crankshaft journals, camshafts, rocker spindles, etc., would appear to be imminent, although it is significant that at the time of the Show the treatment was confined to the cylinder barrels only of the Hispano-Suiza engines.

A further point of interest regarding the monobloc type of construction lies in the method of fitting the cylinder assembly to the crankcase. The British practice, as exemplified by Rolls-Royce and the A.D.C. "Nimbus," is to locate the cylinders by flanges turned on the barrels near their lower ends, the bottom of the jacket blocks being clear of the crankcase. All the other engines of the type at the Show, however, had their jacket blocks secured to the crankcase, the inner ends of the cylinders being free to slide in their sockets. The method of securing the Rolls-Royce cylinder blocks to the crankcase is interesting; long bolts are anchored to the head portion of the combined head and jacket casting and to the crankcase, these bolts serving the dual purpose of securing the heads to the barrels and the assembly to the crankcase. The barrels are open-ended and are provided with aluminium packing rings to form gas-tight joints with the head. In the case of the "Nimbus," the cylinder assembly is secured to the crankcase by claws which engage with the flanges formed at the lower ends of the barrels. The head of this engine is a separate casting to which the cylinder jackets, formed in two blocks of three each, are bolted; the cylinders are closed ended, the head being secured to the cylinder ends by the screwed-in valve seats. The latter form of construction was the most common among the engines having separate cylinders secured to a common head unit, the jackets of every engine of this type being of thin steel welded to flanges on the barrel at the top and bottom, corrugations in the jacket being provided in most instances to allow for expansion, the Napier "Lions" forming a notable exception. It is of interest to observe that in five of the eight broad-arrow type engines at the Show, the cylinder construction was of the type originated by Napier's, the exceptions being provided by the two Lorraines and the Farman inverted. The latter engine was unique in having the cylinder block castings of Alpax, an aluminium-silicon alloy.

Valve Gear.—The only exception to the use of an overhead camshaft or shafts for operating the valve of each cylinder bank among the water-cooled engines was provided by the Sunbeam "Sikh III," which enjoyed the double distinction of having six push-rod operated valves per cylinder. There exists, however, a considerable variety in the design of valve actuating gear. Four valves per cylinder were provided in the majority of cases, but two only were employed by two French firms, Lorraine and Hispano-Suiza, the latter throughout their range of engines, but only in the older engines shown by the Lorraine Company. These two Lorraine engines were also unique in having partially exposed rocker gear and inclined valves. In all the other engines the valve gear was totally enclosed and the combustion heads in almost every case were flat, the valve stems thus being parallel to the cylinder axes. Although the provision of four valves per cylinder was general, it was a little surprising to find that only about 30 per cent. of the water-cooled engines were fitted with twin camshafts, and of those that were so provided, the Napier "Lions" were alone in having the cams acting directly on the valve stems. For sheer simplicity and lightness it can hardly be possible to better the Hispano-Suiza arrangement of single camshafts operating directly on the stems of the two valves located on the fore and aft centre line of the head, which arrangement also permits the use of a modified form of "pent-house" type combustion head if desired.

(*To be continued.*)

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any bookseller.

MEASUREMENT OF LATERAL DERIVATIVES ON THE WHIRLING ARM. By L. W. Bryant, B.Sc., A.R.C.S., and A. S. Halliday, B.Sc., D.I.C. R. & M. No. 1249 (Ae. 400). (6 pages and 12 diagrams.) March, 1929. Price 6d. net.

It was required to measure the rotary derivatives due to a continuous yawing rotation on the tenth-scale model of the Bristol Fighter; thus, to supplement the measurements of Lp and Np on the rotation balance at the Royal Aircraft Establishment,* and to provide a check (particularly at incidences above the stall) on the oscillation method of experiment employed in R. & M. 932.†

The rolling and yawing couples due to a constant rate of yaw in absolute units ($rs/V = 0{\cdot}0653$) were measured from 2° to 30° incidence. Observations were also taken with rudder set over ± 30°, and with fin and rudder removed. A comparison, both for wind and for body axes, was made between the results of the continuous rotation and those of the oscillation methods of measurement of the four derivatives, Lp, Np, Lr, Nr.

Owing to the high value of the swirl in the shed, due to the rotating arm, its radial component produces a resultant angle of sideslip at the model of

* R. & M. 787. Lateral Control of Bristol Fighter at low speeds. Measurement of rolling and yawing moments of model wings due to rolling.—Miss Bradfield, R.A.E.

† R. & M. 932, Section 2. Lateral Derivatives by the forced oscillation method.—Frazer, Batson, and Gadd.

about 3½°, and further, there is a considerable variation in pitch from wing tip to wing tip. It is considered that fairly satisfactory corrections have been made for these two effects, but it is desirable for future work on the arm, to endeavour to reduce the swirl as far as practicable.

The agreement between the results of the two methods of measurement is fairly good, except for the very large discrepancy in Np referred to chord axes at angles of incidence above 13°. The influence of the fin and rudder above the stall is very small, whilst below the stall they account for about one-half the value of Nr referred to chord axes. Rudder power appears to be little changed by the rotation.

After attempting to reduce the rate of swirl caused by the arm, it is proposed to repeat some of the measurements of Lr and Nr where they appear to need confirmation, the measuring apparatus being improved; subsequently it is desirable to measure Mq to provide information very much needed for the study of control at low speeds and of spinning.

REPORT ON SOME PROPERTIES OF ALLOYS OF ALUMINIUM WITH THORIUM AND SILICON. By J. D. Grogan, B.A., and T. H. Schofield, M.Sc. Presented by Dr. W. Rosenhain, F.R.S. Work performed for the Department of Scientific and Industrial Research. R. & M. No. 1253. (M. 64). (12 pages and 20 diagrams.) April, 1929. Price 1*s.* 6*d.* net.

The present investigation forms part of the programme of research on alloys of aluminium to discover new alloys capable of improvement by age-hardening or "modification." The alloys of aluminium and thorium were selected because the published equilibrium diagram showed the existence of a eutectic at 25·6 per cent. of thorium; this fact suggested the possible existence of a range of solid solubility and of a eutectic structure suitable for modification.

The alloys have been studied in an exploratory manner with a view to the above possibilities. Binary alloys containing up to 12·7 per cent. of thorium and two ternary series containing 5 and 10 per cent. of thorium with varying quantities of silicon were examined. The alloys cast as 1 in. diameter chill cast bars were rolled into strips 0·05 in. thick. The tensile strength and Brinell hardness were determined on this material after annealing, quenching and quenching followed by reheating to a lower temperature. A number of measurements of electrical conductivity were also made.

Thorium and silicon separate from solution in molten aluminium as the compound $ThSi_2$. As the highest grade aluminium commercially obtainable contains sufficient silicon to combine with about 1 per cent. by weight of thorium, the investigation of the binary aluminium thorium system becomes difficult when the thorium content is very low, the system being then ternary rather than binary. For this reason the determination of the limit of solid solubility of thorium in aluminium is difficult. The limit is low and the alloys are not improved to any considerable degree by heat-treatment and do not possess mechanical properties of value. Similarly the solid solubility of the compound $ThSi_2$ is low and the mechanical properties of its alloys are poor. Neither the binary nor ternary alloys appear to be capable of modification to any valuable extent by the action of sodium fluoride.

In view of the fact that thorium is both heavy and expensive the investigation has not been pushed further to the study of other ternary alloys or other possible methods of modification.

COMPARISON OF CALCULATED AND MEASURED ELASTICITY OF AIRCRAFT WINGS, IN CONNECTION WITH THE INVESTIGATION OF WING FLUTTER. By K. T. Spencer, B.Sc., A.M.I.C.E., and D. Seed, A.M.I.C.E. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1257. (Ae. 406). (9 pages and 2 diagrams.) April, 1929. Price 9*d.* net.

The present report arises out of a recommendation put forward by the Aeronautical Research Committee that comparison should be made between the stiffness of an aircraft wing as calculated from drawings, and as measured from a mechanical test.

Calculations have been carried out representing as closely as possible the external loading conditions taken in the mechanical test, an account of which is given as an Appendix. The deflections at the outer gap struts and at points along the spar have been determined.

In general there is good agreement between the calculated and measured values of the deflections.

NOTES ON THE FLUTTER OF AIRSCREW BLADES. By E. Lynam. Presented by the Director of Scientific Research Air Ministry. R. & M. No. 1258. (Ae. 407). (5 pages and 6 diagrams.) April, 1929. Price 6*d.* net.

Experience has shown the necessity for the outer third or so of the length of airscrew blades to be thicker than demanded from considerations of steady stress, in order to prevent flutter.

As such thickening is detrimental to efficiency, particularly at high tip speeds, it is important that an attempt should be made to evolve an explanatory theory which would be of practical assistance to designers in avoiding flutter with least detriment to efficiency.

The note collects together a number of observations which have been made in this connection during many years practical experience with airscrews, both wood and metal. Also, the results of some experiments bearing on the subject made at the R.A.E. are given.

Whilst no theory has so far been evolved, experience has shown that with solid airscrew blades of conventional cross section, flutter can be prevented by increasing the thickness/chord ratios of the sections over the outer third or so of their length. A curve giving the variation of thickness/chord ratio of the sections of mahogany blades of normal chord/diameter ratio and shape, which has been found from experience to give airscrews generally free from serious flutter in all normal conditions of use, is given.

FLIGHT TESTS ON AN ATLAS FITTED WITH AUTOMATIC SLOTS CONNECTED WITH THE AILERONS AND SOME DATA RELEVANT TO THE DESIGN OF AUTO-SLOTS FOR R.A.F. 28 SECTION WING. By E. T. Jones, M.Eng., Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1260 (Ae. 409). (8 pages and 6 diagrams.) March, 1929. Price 6d. net.

Connection between the ailerons and automatic wing-tip slots was suggested by Mr. McKinnon Wood as a means of increasing the lateral control of an aeroplane at stalling incidence.

Qualitative flight tests of the lateral control and stability of the aeroplane have been made throughout a large incidence range for, firstly, the standard non-slotted aeroplane, secondly, the slotted aeroplane, and thirdly, the slotted aeroplane with the auxiliary aerofoil connected with the ailerons. The free setting of the auxiliary aerofoil was observed, and curves are drawn showing the angular movement of the front link against incidence for slight variations in rear link lengths and angles.

A slot which was found to be very efficient at the stall is defined by: lengths of front and rear links 0·095 c. and 0·106 c. (where c is the main wing chord), respectively; angles of front and rear links, 25·0° and 22·5°, respectively. Without slots, the aeroplane is laterally unstable at stalling incidence, and the ailerons give practically no lateral control. The lateral stability at stalling incidence with slots is most marked, but there is no lateral control.

With auxiliary aerofoils connected with the ailerons, the lateral stability at stalling incidence with control column central is the same as in the slotted aircraft, while the lateral control is very fair, though by no means powerful. The lateral control in the speed range, 15 m.p.h. above stalling speed, to about 95 m.p.h., is adversely affected by the connection, and in bumpy atmospheric conditions, the aircraft is most unpleasant to handle within this speed range.

It is possible that R.A.F. 28* section wing is unsuitable for this type of control, and/or that the wing tip form of the "Atlas" gives rise to a very disturbed airflow over the ailerons.

Flight tests on a "Siskin" fitted with auto-slots connected with the ailerons are to proceed as soon as the aircraft is serviceable. The "Siskin" has a modified R.A.F. 15 upper wing, and a different wing-tip form from the "Atlas"; the undesirable features of the control, when fitted to the "Atlas," may therefore not appear on the "Siskin."

* R. & M. 1165. Wind-Tunnel experiments on the design of an automatic slot for R.A.F. 28 section, and on interconnection with aileron.—By F. B. Bradfield and K. W. Clark.

THE APPLICATION OF THE FLETTNER SERVO PRINCIPLE TO AILERON OPERATION. By A. S. Hartshorn, B.Sc. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1262. (Ae. 411). (16 pages and 9 diagrams.) March, 1929. Price 9*d.* net.

The servo principle has provided a practical method of operating large rudders and the question arises whether it is practicable to apply this principle to ailerons, which for the large aeroplanes now being manufactured develop a hinge moment uncomfortable or impossible for the pilot to control by hand. With rudders, the servo flap has usually been carried on outriggers behind the rudder, as for instance on the "Singapore," but recent theoretical and wind tunnel work has shown that the servo can be attached directly to the trailing edge of the rudder, and in fact become the trailing part of the section used for the rudder without impairing the efficiency of the system noticeably. Further details of the servo system as applied to rudders can be found in Reports Nos. R. & M. 1105, R. & M. 1187, R. & M. 1186.*

The servo system here considered has a servo flap which is part of the ailerons, and the gearing is that used for servo rudders and is called "follow-up gearing."

For any given aileron angle the force on the control column can be lightened to any desired extent by factors completely under the control of the designer, but the rolling moment is reduced as the control is lightened.

If no limit be set to the force which a pilot can exert then the maximum rolling moment possible with servo control is always less than that without it. If, however, we fix the maximum force to be exerted by the pilot, then as the scale of the aircraft is increased a limit is reached above which a larger maximum rolling moment can be produced with a servo control than without it.

The possibility of a greater rolling moment efficiency with the outrigger type of servo flap is considered and wind tunnel tests on this type are recommended.

* R. & M. 1105. The aerodynamics of a simple servo rudder system.—H. M. Garner and C. E. W. Lockyer.

R. & M. 1187. On the use of follow-up mechanism in aerodynamic servo control systems.—H. M. Garner and K. V. Wright.

R. & M. 1186. Wind tunnel tests of various servo rudder systems.—K. V. Wright.

FULL-SCALE DETERMINATION OF THE MOTION OF AN AVRO AEROPLANE WHEN STALLED. By K. W. Clark, B.Sc., D.I.C., and W. G. Jennings, B.Sc. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1263. (Ae. 412). (6 pages and 12 diagrams.) April, 1929. Price 9*d.* net.

This report deals with the full scale determination of the initial movements of an Avro aeroplane at large angles of incidence on the application of certain controls. Similar full scale experiments have been carried out on a Fokker VII monoplane and a standard Bristol Fighter, and are described in R. & M. 1228* and R. & M. 1181† respectively.

The tests were carried out during the period May, 1927 to November, 1928. The development of the method of measurement occupied a considerable portion of this period, and it was necessary to make a number of flights before the recording instruments could be made to work satisfactorily.

An Avro 504 N aeroplane fitted with a Lynx IV engine was used for the tests. The motions of the aeroplane at various initial angles of incidence when certain controls were applied were recorded photographically by suitable instruments. The movements of the controls were recorded simultaneously.

Up to an initial incidence of 24° in steady flight the ailerons generated a sympathetic rate of roll. At 24° incidence the aileron control was uncertain, and in some tests a rate of roll against the ailerons resulted.

The rudder control was effective up to 24° incidence in producing a well-defined angular velocity in yaw.

* R. & M. 1228. Full scale control tests on Fokker F.VII 3M monoplane.—J. K. Hardy.

† R. & M. 1181. Instrumental records of the lateral motions of a stalled Bristol Fighter aeroplane.—B. M. Jones and Flight-Lieut. Maitland.

AIR TRANSPORT

FRENCH AIR TRANSPORT MERGER

THE following details regarding the French Government's scheme for merging the commercial air lines into three "systems" are given in the Résumé of Commercial Information issued by the Air Ministry. The agreement for the "Eastern" system, which it is intended shall be effective for a period of 30 years, involves the amalgamation of the Air Union and Air Union Lignes d'Orient, and provides for the operation of air transport services on the lines—Paris-London, Paris-Lyons-Marseilles, Marseilles-Tunis, Marseilles-Athens-Syria, and later extensions to Indo-China and the Far East on the one hand and Egypt on the other.

The capital of the new company, which is to be fixed at 60,000,000 fr. (£483,480), is to be held as follows:—25 per cent. each by the Air Union; the Air Union Lignes d'Orient; P.L.M., Nord and Etat railway companies, shipping companies, leading banks and groups of users; and the French Government.

A subsidy will be paid to the company in the form of a kilometric bonus, the rate of which will be calculated according to the horse-power and type of aircraft employed (aeroplane or seaplane) and the zone in which the service is operated. The total subsidy for 1930 is fixed at 56,000,000 fr. (£450,000 approximately) and 74,000,000 fr. (£600,000 approximately) for 1931; thereafter the amount will be gradually reduced, the reduction at the end of five years being 10 per cent., at the end of the tenth 30 per cent., fifteenth 50 per cent., twentieth 70 per cent., and at the end of the twenty-fifth, 85 per cent. Up to 50 per cent. of the aircraft employed may be of foreign construction.

The agreement for the "Continental" system, which will consist of services from Paris to the European capitals, involves the amalgamation of the Cie Internationale de Navigation Aerienne and Cie. Générale de Transports Aeriens (Farman). The capital of the new company will be 60,000,000 fr. (£483,480), the same as that of the company which is to operate the "Eastern" system, and will be allocated in the proportion of one-third each to the C.I.D.N.A., the Farman company and the State. The terms of the agreement are almost identical with those of the agreement relating to the Eastern system, except that the maximum annual subsidy is fixed at 48,550,000 fr. (£391,220).

It was originally intended that the "Westward" system, consisting of lines to Africa and South America, should be operated solely by the Cie. Générale Aéropostale, but after a 20-years' agreement had already been drawn up between that company and the government, the Compagnie Air Afrique, a company which was formed by Commander Dagnaux last year, and which had already carried out a considerable amount of survey work in connection with the African section of the proposed France-Madagascar air line, applied to the government for authorisation to participate in the operation of African services. Their claim was supported by the Governor-General of Madagascar, and after protracted negotiations it was decided to subdivide the "Western" system into South American and African services, and to entrust the operation of the latter to a new company which would combine the interests of the two rival concerns. A company known as the Compagnie Transafricaine (Offices: 12, Rue d'Anjou, Paris) was therefore formed with a capital of 6,000,000 fr. (£48,350) (to be increased to 60 million francs—£483,480—on ratification of agreement) divided equally between the Aéropostale and Air Afrique, and with a board of directors consisting of eight directors from each company, the managing director being Commander Dagnaux.

Meanwhile, the Cie. Générale Aéropostale continued to develop its system with a view to connecting up with the U.S.A. From Natal (Brazil) a line will be run through Venezuela to North America via the West Indies, the Venezuela Congress having voted grants for a line to Europe, via Natal.

A new air line involving crossing the Andes, at a height of about 5,000 metres, has been operated since last July from Buenos Aires to Santiago de Chile. European mail, which was previously sent from Buenos Aires to Chile by transandean railway, is thus accelerated by 48 hours.

An agreement was concluded between the Compagnie Générale Aéropostale and the Chilean government for the conveyance of mails by air. The contract, which is for five years, guarantees that the Aéropostale shall carry half the mails for Bolivia, Peru and North America.

New developments are also occurring in Europe, a service between Paris and Madrid having been commenced in July last. The company is experimenting with a new machine on this line, namely, the Laté 28, a very luxurious monoplane for eight passengers. Wide glass windows give an excellent view, and the pilot's cockpit is cowled over. With a 600-h.p. Hispano-Suiza engine, this machine, which attained a speed of 240 km./hr. at its tests, has a cruising speed of 200 km. (124 miles per hour) with one ton of useful load.

FIRST KARACHI-DELHI AIR MAIL: Mail and freight being loaded in the Imperial Airways' "City of Delhi" D.H. "Hercules" air liner at Karachi, on the occasion of the opening of the extension of the England-India air route between Karachi and Delhi.

A SECOND AVRO "FIVE" FOR KENYA: Our picture shows the "Knight Errant," the second Avro "Five" ordered by Wilson Airways of Nairobi, Kenya Colony. The first machine, "Knight of the Grail," was delivered by air by Capt. Campbell Black, who will shortly fly this second machine out to Kenya.

Guineas for Guinea Airways, Ltd.

THE other week we referred to the work of Guinea Airways, Ltd., in New Guinea, and below we give some interesting figures regarding the financial position of this concern. For the six months ended August 31, Guinea Airways, Ltd., earned a net profit of £8,872, or 44·36 per cent. of its capital of £20,000, and paid a dividend of 20 per cent. Gross revenue from the carriage of cargo, passengers and mail, launch freights, and interest was £27,543. General expenses absorbed £14,282, depreciation on five aeroplanes, buildings, launch, and plant amounted to £3,389, a bonus of £500 was paid to the field staff, and a bad debts reserve of £500 was created. Two dividends of 2*s*. each absorbed £4,000, and £5,000 was appropriated as a general reserve fund, leaving £2,098 to be carried forward, compared with £2,225 brought into the accounts. On August 31 fixed assets aggregated £15,979, and liquid items £15,273, and outside liabilities amounted to £4,154. Another dividend of 2*s*. a share has since been paid. The company has a contingent liability of £9,270 for a fourth Junkers aeroplane, two new Bristol Jupiter engines, and two steel lighters, which are on order for delivery early in 1930. As the company has become firmly established, the board is considering reducing charges.

Vancouver Municipal Airport

THE new Vancouver municipal airport is to be constructed on a site of 460 acres situated on the south side of Sea Island, fronting on the north arm of the Fraser River. It provides facilities for both land and sea machines, and is claimed to be one of the finest airport sites on the American Continent. It is reported to have cost $226,000.

Air Transport in Fiji

MR. N. S. CHALMERS, the first man to purchase an aeroplane (a Gipsy Moth) for use in the Fiji Islands, states that transport conditions on the Fiji Islands are such that flying offers the only solution for linking up Suva with the remote settlements and sugar plantations. The boat trip from Ba to Suva (150 miles) ordinarily takes about three days, and the roads were impossible because of the enormous tropical rainfall. The aeroplane would reduce the time of the journey to about two hours.

Capt. Guest Returning Home

CAPT. F. E. GUEST, Chairman of N.F.S., who went to Africa last year to explore the possibilities of civil aviation in East Africa, is returning home. It is understood that he has failed to find sufficient opening to warrant his company exploiting East Africa at present.

Palestine's New Airport

THE purchase of 500 acres of land for an aerodrome for civil aviation is the most recent move in the development of Haifa, the new port of Palestine, which (writes a correspondent) is destined to become one of the most prominent ports of the Levant. Final arrangements have not yet been made, but it is anticipated that Haifa will become a link in the air route to India which will, of course, cut out the greater part of the Mediterranean crossing. The whole of the land where the present aerodrome site is situated was a malarious swamp on the banks of the biblical river Kishon. Part of this has been drained under the Government reclamation scheme, and another large area by the Jewish colonisers. All over Palestine vast areas of malarial swamp have been made into good land available for either agricultural or industrial enterprises, and malaria, while not completely eliminated, is under satisfactory control.

A New Czecho-Slovak Air Service

CZECHO-SLOVAK State Air Lines propose to open next spring an air service between Prague and Cluj (Roumania), via Brno, Kôrice and Uzhorod.

French Mail 'Plane Missing

A FRENCH mail 'plane operating on the Casablanca-Alicante section of the France-South America air route, which left Casablanca on January 24, is reported missing. It is feared that bad weather was encountered between Rabat and Tangier and the machine crashed in the sea.

Canada-South America Air Mails

ARRANGEMENTS have been completed for air mail connection between Canada and the United States, making it possible to carry mails from the Arctic Circle to South America (about 12,000 miles) within a couple of weeks.

Germany-South America Flight

SENORES LUIZAÉA and Vasquez, two Bolivian army pilots left Dessau on January 24 in a "Bremen"-type Junkers monoplane in an attempt to fly for South America by stages.

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R 100 FLIES FOR 54 HOURS

THE airship R 100 left the tower at Cardington at 9,38 a.m. on January 27 on an endurance flight of at least 48 hours, in order to qualify for her certificate of airworthiness. Major G. H. Scott was in supreme command, with Squadron-Leader R. S. Booth, A.F.C., as captain of the ship. There were 56 people on board, including Sir Dennistoun Burney. The weather was foggy during the greater part of the flight, and in several towns, including London, people heard her engines without being able to see the airship. On Monday she flew past Oxford and Bristol, down the Bristol Channel to Plymouth, and then visited the Channel Islands. By 9 p.m. she was off Brighton. She rounded Dover during the night, and in the early hours of Tuesday, 28th, she was reported off Lowestoft and Yarmouth. At 10.15 a.m. she was over London. Then she flew towards Swanage and down to Torquay, Plymouth and the Eddystone lighthouse, which she reached at 9.45 p.m.

The following notes on her direction-finding wireless apparatus will be of interest. The direction finders were supplied to the Air Ministry by the Marconi Company, and are known as the Type R.g.14, specially designed for use in aerodrome stations. The receiver is used with two triangular loop aerials and a single wire open aerial. Three types of reception are provided for, the "circle" diagram, the "figure of eight" diagram and the "heart-shaped" diagram. The radiogoniometer is mounted as a separate unit and is normally arranged for single channel working, but if required a double directional radiogoniometer can be provided so that more than one receiver can be operated from a common aerial system.

At 7.20 a.m. on Wednesday, the 29th, R 100 reported her position as over Mullion in Cornwall, by 9.15 a.m. she was near Barnstaple in Devon, and at 3.15 p.m. she moored again to the tower at Cardington after spending about 54 hours in the air.

CORRESPONDENCE

[The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.]

ANOTHER GRIEVANCE

[2271] I am a regular reader of FLIGHT and keenly await each issue.

I should like to say how disappointed I am in the attitude of our larger aircraft manufacturers. Why on earth do they go spending money on purchasing the manufacturing rights of foreign commercial machines when there are brains in the country which could produce even better machines if they were given the chance. Surely this is proved by the fact that in most—dare I say all ?—cases where the rights have been purchased the manufacturer concerned has redesigned the aircraft to a very large extent before marketing it and if we have the brains to do this it stands to reason that we could design the machine in the first place.

Aircraft like the Westland IV, Argosy, Supermarine and the machines Vickers sends to Bolivia are as good as the best, and taking a line from these there can be nothing about Fokker or Koolhoven machines which our designers could not beat if they tried.

It is just the same in the case of engines. Whyever should firms who have money to spend on making engines, send it out of the country by buying the rights of French engines. If they were to spend this money by paying a designer from, say, Villiers, Ariel, New Imperial, Calthorpe or Rudge, surely they would get better value and at the same time keep the money in this country. If such firms were to take a hand themselves I do not think it would be long before we should have an engine which would make things " hum." Just look at the little 1·72-h.p. Villiers-engined machines which, with a weight of 224 lbs., do 65-70 m.p.h. over Irish roads !

I can sympathise with Mr. A. Crosse and Mr. O. F., but my advice to them is " to go and get your licences." The time is coming when the demand for pilots will exceed the supply, but only those who have studied navigation will get the " plums."

When I was a 3 ackemma I used to pray for the day when something S.E.5ish, would come within the limits of my pocket and I wonder if it is possible to get anything like the Camel, Anec, Wee Bee, Avro Monoplane, Hawker Cygnet or D.H.53 cheap ? The Wee Bee and Cygnet appeal to me especially.

Wake up England and beat foreign competition before it beats you !

FROM ONE WHO'S GRIEVANCE IS VANISHING

Belfast.
January 10, 1930.

GLIDING

[2272] With reference to your article in this week's paper regarding the glider and sail plane movement in this country, I was astonished that you state that the type of aircraft that has been evolved from German sail 'planes, *i.e.*, low-powered machines of the light aeroplane type, are now being superseded by the more orthodox British light 'plane. I have had a good deal of experience with German light aeroplanes, and I entirely disagree with you ; in fact, the low-wing post-war cantilever monoplane which was evolved from the sail 'plane is in most aviation circles talked of as being the light aeroplane of the future, and several well-known British firms, including Boulton and Paul, of Norwich, are going away entirely from your so-called " more orthodox " British light aircraft design, to build this off-shoot of the German sail 'plane, as a powered machine.

Junkers, who without doubt are one of the leading civilian aircraft designers in the world, are another firm that entirely designed their machines from knowledge gained through experimenting with the glider. Likewise the Klemm low-wing monoplane. Any pilot who has flown one of these low-wing cantilever monoplanes, even with their exceptionally large span, will tell you that their manœuvrability, take off, landing and climb, and particularly their wonderful flying and landing view, is far in advance of the biplane type that is used in this country, considering the horse-power.

Gliding, as you say, or more correctly, sail 'planing, is only a sport, and extremely good fun, but what does the average private owner in this country buy a machine for, but to obtain sport and fun ; also, if the sail 'plane movement in this country is fostered it will give a chance to dozens of air-minded people, who, at the moment, cannot afford to fly or run a so-called higher powered and more orthodox designed and expensive light aircraft.

London, W.1. J. ROGERS.
January 24, 1930.

[2273] The articles in FLIGHT seem to me to miss the main point in reference to gliding. The aim should be to attain to true soaring flight, as practised by the great soaring birds. We know that eagles, vultures and gulls can, after the initial take-off, rise in the air and maintain flight without beating their wings. This cannot be merely by sitting on upward currents from hills, as they can soar just as well over flat country or water, if there is not too little or too much wind.

Two conditions are requisite—that the loading is not more than about 1½ lbs. per sq. ft., and that the wings have a high aspect ratio. The albatross, weighing about 20 lbs., has a span of 12 ft. and chord of less than 1 ft.—about 9 ins. No short-winged bird can soar, no matter how powerful the flight in other respects.

It would be impossible to construct a glider on this model on monoplane or biplane lines without making it too large to be handled, but it could easily be done by taking the Maneyrol tandem monoplane, and fitting two more wings above, making it into a tandem biplane. The plane weighed about 150 lbs., say, 100 lbs. extra, for the alterations, wings 25 by 4 ft., the total area 400 sq. ft., weight with pilot about 400 lbs., and 100 ft. of entering edge.

No glider has yet been built with anything like this loading, and I believe that with such a machine it would be possible to attain the final conquest of the air, and especially in view of the fact that the Maneyrol glider was reported to possess remarkable controllability, a very valuable quality in a glider.

H. G. BUTT

Cheltenham.
January 25, 1930.

[Our correspondent's suggestion of using a tandem biplane in order to obtain very light wing loading is not, we are afraid, likely to lead to success, the tandem arrangement of aerofoils being very inefficient aerodynamically. Maneyrol's Peyret glider was *not* an efficient one, but it did score through being very controllable. For his duration flight of more than three hours Maneyrol had a very strong wind. Had the wind been light he could not have made the flight on that machine.—ED.]

AVIATION OLD TIMERS

[2274] As one whose interest in aviation extends back to 1910, and learned to fly on an Anzani-Bleriot in 1912, I think Mr. Thorburn has put forward a most excellent suggestion in his letter [2223] when he asks you to publish an " Old Timers " number.

Apart from the names he mentions, I often wonder what has happened to Horatio Barber, of " Valkyrie " fame, Mrs. de Beauvoir Stocks, who flew at the Grahame-White school., Mrs. Buller, who piloted a Breguet, Clement Greswell and his Bleriot, Radley, who built his Bleriot types near Bedford—but to go on one could mention scores of names which have faded from memory with the passing of time.

I hope others of your readers will support Mr. Thorburn's suggestion sufficiently to induce you to publish this " Old Timers " number.

Needless to say, I look forward to the weekly mail which brings me my copy of FLIGHT, and with best wishes for your continued success.

Johannesburg, S. Africa. ARTHUR CLARK
January 5, 1930.

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Lord Trenchard

THE barony conferred upon Marshal of the Royal Air Force Sir Hugh Montague Trenchard is gazetted by the title of Baron Trenchard of Wolfeton, in the County of Dorset.

Schneider Trophy Pylons to be Broken Up !

H.M. DESTROYERS " Umpire " and " Urchin," which were used as pylons during the last Schneider contest, have been sold out of the Navy to be broken up.

CERTIFICATES OF AIRWORTHINESS*

By H. B. HOWARD, B.A., B.Sc., F.R.Ae.S.

THE object of the present paper is to place before the Society certain general considerations regarding the effect of airworthiness regulations on the design of civil aircraft.

I should like first to thank the Air Ministry Authorities for permitting me to read this paper, and to explain that any opinions expressed are entirely my own.

The Air Navigation Regulations which set up organised Government control of civil aviation in this country, came into effect on May 1, 1919, so that the influence of Government supervision has been present during the whole period of post-war development of civil aviation.

The law protects those members of the public who wish to fly, and more particularly those who pay to do so, in numerous ways.

Before a passenger-carrying aircraft can fly, the pilot, the navigator, the ground engineer and the aerodrome must all be licensed. The instruments and equipment must be of approved types, and lastly the aircraft itself must possess a certificate of airworthiness. Moreover, this certificate must be renewed yearly after a thorough inspection.

The granting of the certificate is conditional upon compliance with a host of regulations, covering the design, materials of construction, and workmanship in the aircraft. So wide a field is covered that only a few points can be touched on here, and I am accordingly only considering the certificate of airworthiness as it affects the design of the aircraft itself, apart from the engine.

Safety in any form of transport is a relative term, and this seems especially true of aviation.

With increasing knowledge, our view of what constitutes a safe aeroplane automatically changes.

Aircraft which a few years ago were regarded as thoroughly satisfactory would now be considered relatively dangerous. In fact, many of the types which have made aeronautical history could certainly not have been granted a certificate of airworthiness. But this is not a criticism of the system. The general public cannot be expected to take the same risks as the pioneer.

All that regulations should do is to crystallise informed opinion as to the minimum desirable standards; but these standards are, in many particulars, still a matter of opinion and, therefore, of controversy.

We have, in consequence, to give a legal meaning to the term "airworthiness," by means of specific rules which must, in very large measure, be entirely empirical.

Now it might be supposed that these safety precautions would not exercise any great influence over the design, and that they merely stop the designer from doing something he would not want to do in any case; that they were, in fact, on a par with the law which prohibits you from marrying your grandmother. But this is not the fact. Some of the most vital safety conditions are fundamental in the lay-out of the design.

I do not, for one moment suggest that with no legal restrictions no safe aircraft would be produced. If the law did not lay down minimum airworthiness conditions for him, the designer would lay them down for himself. The two sets might quite reasonably differ in details, but in either case they would be of fundamental importance.

Compared with other forms of transport, safety considerations play an immeasurably greater part in the design of aircraft, and incidentally in the commercial value of the resulting vehicle.

From this point of view, the design features of an aircraft can broadly be divided into two groups: first, those attributes which can be corrected by a "trial and error" process, such as stability and controllability, which even if found unsatisfactory on a first trial can usually be corrected by changes in the size or disposition of control surfaces; second, those qualities which are fundamental in the design and which cannot be subsequently modified to any great extent. The principal example in this class is structural strength. Other cases are horse-power and surface loading to achieve a safe take-off, and a system of load distribution to give a satisfactory position for the centre of gravity.

It is of paramount importance, therefore, that the legal provisions shall be so drafted that they represent the best current practice in airworthiness. Only by this means can the designer be given the maximum legitimate measure of freedom. Briefly, the law should only impose those restrictions which the experienced designer would impose upon himself.

I propose to discuss briefly certain aspects of this problem which seem to me of basic importance.

Take-off Requirements

It is required that every new type of civil aircraft submitted for a certificate of airworthiness shall clear a barrier 20 m. high in a certain stated distance, starting from rest, against a wind of not more than 8 km. per hour, and in addition, climb to a stated height in 3 mins. These times and distances vary with the class of aircraft, and the figures are as follows:—

Type	Distance to climb 20 metres	Height to be climbed in 3 minutes
Public transport for passengers . .	500 m.	420 m.
Special category aircraft . .	750 ,,	360 ,,
Other aircraft	600 ,,	360 ,,

The intention of these regulations is obvious. The barrier test is to ensure that on taking off the aircraft will clear houses, trees, etc., on the edge of the aerodrome. The climb to height is to ensure that a safe flying height can be reached sufficiently rapidly to minimise the risk of engine failure near the ground.

These standards are identical with those agreed internationally as minima, except for the passenger-carrying class. Here we have nationally reduced the distance in the barrier test from 600 to 500, and increased the height in 3 mins. from 360 to 420 m.

It might be noted that these two conditions are not, nor are they intended to be consistent. An aircraft may satisfy one without satisfying the other. Broadly, the climb to height usually limits the weight of the lightly loaded, lower speed aircraft, and the barrier test that of the higher speed, more heavily loaded, types. It is, I think, open to argument whether this secures the same measure of safety on all types In 3 mins. from rest a high-speed passenger carrier will, even at its climbing speed, have travelled a considerable distance In a country of so uneven a contour as our own it might be preferable to satisfy that a safe height had been reached in a certain distance, rather than in a certain time from rest.

The necessary standard of take-off performance is largely determined by the available aerodromes and the nature of the country over which flight is intended. The choice of a suitable aircraft for particular operational conditions is left almost entirely to the judgment of the operator. No special reference is made on the certificate to these conditions. The take-off requirements have accordingly to be adjusted to what may be broadly termed normal conditions in this country. There seems the possibility that this may handicap the development of specialised aircraft. Under existing procedure, for example, the same take-off requirements apply to a small light plane two-seater for training purposes or taxi work as to the large passenger carrying type. The latter, perhaps, would always operate on large aerodromes of good surface, and under closely watched conditions. Provided a good angle of climb is achieved on leaving the ground a long run to unstick would appear less detrimental than in an aircraft required for general use on any aerodrome.

Structural Strength.

In our present state of knowledge, the answer to the question, "Exactly what strength should this aircraft have?" is, to be perfectly candid, "Nobody knows." But this confession of agnosticism need cause no alarm. We know enough to make aircraft safe, but we do not know how safe we have made them.

The first obvious and broad dividing line lies between the "acrobatic" aircraft, which are allowed to stunt, and the "normal" aircraft, which are not.

For the "acrobatic" class there is a fair body of evidence as to the loads encountered. Accelerator measurements have been made in this and many other countries during "acrobatics."

Our system of load factors is built up very largely on this kind of evidence. In this branch structural safety is in the hands of the pilot. The designer can only provide the strength which past experience indicates that the pilot ought to require. The responsibility for not over-stressing the aircraft is then on him. The human element is the obstacle to an exact solution. The factor of safety may be the factor of

* Paper read before R.Ae.S. on January 23, 1930.

ignorance, but the ignorance is not what the pilot can do with the aircraft, but what he will do with it.

New developments in control and new manœuvres to which aircraft are put need to be constantly watched from the structural point of view to ensure that reasonable margins of strength are provided.

In the "normal" category the position is different. No acrobatics are in question, and under similar conditions different pilots ought not to produce greatly differing loads on the structure.

It seems reasonable to expect that the importance of the human element will be relatively less. But we are faced with an almost complete absence of satisfactory data of the loads encountered. It was from the outset obvious that lower load factors would be allowed in this class, and accordingly these were reduced to about two-thirds of their value for acrobatic aircraft. The result, as shown by the published reports of accidents, has been that British air transport services have covered some 8,000,000 machine miles without a single accident attributed to structural failure. The chance of such failure may, therefore, be regarded as, for practical purposes, zero. The inference is either that we have got our aircraft just right, or that we have got them too strong. Remembering the arbitrary nature of our methods for determining strength, the suggestion that we have got our aircraft just right is wildly improbable. There seems therefore some reason to hope that strength factors might be reduced in the air liner class without any practical reduction on their safety.

But it is very unwise to leap before you look. Few people keep this more constantly before them than Government Departments, and clearly something more than negative evidence is necessary before any substantial reduction can be made. Unfortunately such evidence is practically non-existent.

The kind of information needed relates to air speed and accelerations. If, for example, records were available showing that a certain type, over a number of flying hours, large enough to be of statistical value, never exceeded its top speed by more than 10 per cent., never encountered an upward acceleration of more than 2 g. nor a downward acceleration of more than $-\frac{1}{2}$ g., such information would form an invaluable basis for fixing its load factors.

I have only quoted figures to illustrate my meaning, but am of opinion that they would be found substantially correct for the large multi-engined passenger carriers.

If these kind of limits could be definitely established, maxima could be fixed for wing loads, tail loads, etc., and a scheme of strength specification built up on a far sounder evidential basis than we at present possess. Such evidence would further enable us to distribute the strength of our aircraft structures in the most efficient manner, and thus aid us in the reduction of structural weight.

Much remains to be done to make our knowledge of the structural problem more precise. Almost every new development in aeronautices has its reaction on the structural side, and only by close and continuous study and a steady accumulation of data will the most economic use of material be achieved

Accidents.

The acid test for any system of airworthiness is the occurrence of accidents. Many safety provisions in aviation, as in other fields, owe their origin to this cause. The importance of their study needs no emphasis.

From this point of view the last ten years of civil aviation in this country show a very creditable record. Interesting details and statistics will be found in the Annual Report on the Progress of Civil Aviation, published by the Directorate of Civil Aviation. These include all the civil accidents investigated by the Inspector of Accidents under the Air Navigation Acts. All the following information is extracted from this source.

The last report, for the year 1928, indicates a progressive increase in safety on a statistical basis.

For the four years 1925-28 there were no accidents in British air transport services resulting in death or injury to passengers. For other aircraft plying for hire over the same period there was only one person killed and one injured; for this latter class the machine miles per accident were 210,000.

But few as these accidents have been, their examination is none the less important. Since April, 1923, the above reports have included a very brief account of each accident with an indication of the primary cause, and the following figures relate to the period April 1, 1923—December 31, 1928.

The causes of the accidents may be classified in any number of ways, according to the particular purposes in mind.

The first broad sub-division lies between those caused by an error of judgment on the part of the pilot and others.

The Inspector of Accidents, in the above reports, indicates how many were, in his opinion, due to errors of judgment. I have prepared Table I from these figures :—

TABLE I

Period	No. of Accidents: Due to pilot's error of judgment	Other causes	Total
1928	17	11	28
1927	13	11	24
April 1, 1926 to December 31, 1926 (9 months)	11	1	12
April 1, 1925, to March 31, 1926	5	0	5
April 1, 1924, to March 31, 1925	4	8	12
April 1, 1923 to March 31, 1924	13	13	26
Totals	63	44	107

Roughly, 60 per cent. of the accidents, according to these figures, are due to the pilot.

But the verdict "Error of Judgment" should, in many cases, be regarded as a criticism of aircraft in general rather than of an individual, and from our present point of view we need a closer examination.

I have accordingly prepared Table II.

TABLE II.—*Accidents to British Civil Aircraft from April 1, 1923, to December 31, 1928.*

Extracted from Annual Reports of Directorate of Civil Aviation

Period	Stalling near ground	Collision	Engine failure	Miscellaneous	Failure to recover from acrobatics	Structural failure	Total
April 1, 1923, to March 31, 1924	4	6	7	6	2	1	26
April 1, 1924, to March 31, 1925	2	3	2	3	0	2	12
April 1, 1925, to March 31, 1926	2	1	0	0	2	0	5
April 1, 1926, to December 31, 1926 (9 months)	5	3	1	2	1	0	12
1927	5	7	6	4	2	0	24
1928	13	5	3	2	2	3	28
Totals ..	31	25	19	17	9	6	107

Here the accidents are divided into the following classes, according to their frequency over the whole period :—

(1) Stalling near the ground.

(2) Collision, either with other aircraft or objects on the ground.

(3) Engine failure.

(4) Miscellaneous causes (including weather) not affected by the airworthiness of the aircraft.

(5) Failure to recover from acrobatics.

(6) Structural failure.

In many accidents more than one cause is operative. The accidents have been classified according to the primary cause, so far as this can be ascertained. Some remarks on these causes are given below :—

(1) *Stalling near the Ground.*—Researches into low speed control are probably too recent to have affected the present figures, but there is no reasonable doubt that accidents under this head will be greatly reduced both in numbers and in consequential damage in future. Control at low speeds and beyond the stall is being continuously studied and our standards of safety in this respect, from the design point of view, are rapidly changing.

(2) *Collision.*—These accidents, though numerically a very large proportion, are often not seriously injurious to personnel. They are usually blamed on the pilot, and emphasise the need for a good field of view as a safety measure.

The next two classes (3) and (4) do not concern us.

(5) *Failure to Recover from Acrobatics.*—This class includes those cases of spins continued into the ground and loops carried out at too low a height. The spinning question, like low speed control, is also being studied continuously, and a better understanding is being achieved of the design requirements to render this manœuvre safe.

(6) *Structural Failure.*—This last, and smallest, class is of special interest in the present connection. Any serious structural defect in design results in a crop of accidents of

the same type. No such tendency is observable here. The causes of the six accidents under this head vary greatly in nature. Such detail amendments in our regulations as they indicated have long since been made. Two of them were fatigue failures of fittings, to which a number of causes, other than the original design, may have contributed. One was the failure of the float chassis of a Schneider Cup racer which, in view of the specially severe conditions, is hardly relevant for civil aircraft in general. Another was due to the fraying of an aileron cable and was therefore partly a maintenance question. The fifth was due to the breaking of a safety belt, a portion of the aircraft which has subsequently been brought under Air Ministry control, and the last was a failure of a wing structure during acrobatics, being the only one on a type of aircraft which has been flown very widely in this country.

It will probably never be possible entirely to eliminate structural failure, so varied are the causes to produce it, but from the design aspect there is no evidence to suggest that our standards are insufficient.

Certificates of Airworthiness from the International Aspect

The International Commission for Aerial Navigation is now engaged in unifying the minimum technical requirements in all countries signatory to the Air Convention. While the idea of international minimum standards is attractive, their establishment is a Sisyphean task. The process of adjustment of our ideas of safety to our state of knowledge renders it never ending. Moreover, there are racial differences which remain ineradicable.

An interesting example occurs in the question of structural strength. One group of nations prefers to test its type of aircraft to destruction; another, to which we belong, is prepared to rely on calculations. Now with aircraft structures, to bring two such systems into line so that they will have the same result in operation, is a practical impossibility. There will always remain considerable likelihood that an aircraft which passes by one system will fail by the other.

This type of difficulty is enhanced by the rapid and independent development of aircraft design in the different countries during the war. We then had no time to exchange ideas as to how aircraft should be built—we were too busy building them. Each nation, therefore, developed its own design technique and tradition which, when the time came for unification, had become partially stereotyped. Had civil aviation evolved naturally with a free exchange of ideas, the problem of internationalisation might have been simpler. This war inheritance is very evident both in our aircraft and our regulations.

But there are deeper differences needing to be reconciled. There is, for example, difference in the methods of use and maintenance. As an instance, from published records of accelerations obtained in America, it appears that American pilots habitually throw greater loads on their aircraft than is the practice here. If this is a fact, higher load factors on American aircraft would be essential to secure the same margin of safety.

Again, behind the actual design there lie the materials and method of manufacture, inspection and maintenance. Agreement on these is necessary, in addition to agreement on design rules, to achieve an equal standard of air-worthiness.

Similar differences arise in the matter of take-off performance, though here they are topographical rather than racial. Variations in size, surface and altitude of aerodromes and in the contour of the country in general may reasonably find their reflection in the take-off performances demanded.

It can be argued that all that is required internationally is an agreement of *minimum* requirements, and that each nation is still free to stiffen up its own regulations. But such a proceeding might tend to create a feeling that the national laws are too severe and in addition tends to hamper a country in its foreign trade.

My own feeling is that internationalisation, though indispensable for some purposes can easily be pushed too far in others, and that experience alone will have to settle how far it is feasible and useful in aircraft design.

THE DISCUSSION

The chairman (Col. Sempill) referred to the controversial nature of the subject of certificates of airworthiness and pointed out that whatever views might be held, it would be agreed that the lecturer of that evening, Mr. Howard, had worked the existing system in a very able manner. He recalled that in the Air Navigation Acts, of 1911 and 1913 there was no mention of regulations concerning structural strength, airworthiness, etc. When the certificate of airworthiness *was* brought in, the whole thing was placed under the League of Nations, and one of the results of this was that two large countries, the United States and Germany, were not signatories. He thought the audience would like the Director of Civil Aviation to tell them something about American airworthiness conditions.

Air Vice-Marshal Sir Sefton Brancker said he never did like regulations, and it was a somewhat curious coincidence that he was now the person responsible for the Government regulations concerning airworthiness. He recalled how once, at Lympne, he went for a flight with the pilot of a well-known aircraft firm in one of their latest types, and was told afterwards by his second in command that in a flight of 5 minutes he had broken no less than four laws!

Concerning the question of American regulations, Sir Sefton recalled that during the years when there were no regulations in America, the list of crashes and fatal accidents was very large.

On the subject of international agreement on load factors, etc., he said that in 1919 it was agreed that regulations were necessary. Ever since that time they had been trying to reach an agreement of standards acceptable to all, but they a d not yet reached such an agreement, and probably never would. He thought the best way out of the difficulty would be to have reciprocal agreements, one country accepting the certificates of airworthiness of the others. In the United States they had what was called an export licence, which was additional to the normal, and which was practically as good as the British C. of A.

Sir Sefton expressed the hope that the insurance companies and operational firms would take over much of the work, and would see to it that each problem was considered on its merits. It would obviously not be practicable for the Government to lay down regulations which would apply to all machines under all sorts of various operating conditions. For instance, regulations that might be very fair and suitable for a machine operating near sea level in this country would not apply if the same machine were operated, for example, from Lake Tanganyika. It was quite true that the British regulations called for high qualities in the aircraft and engine, and that an aircraft which held a British C. of A. was more easily sold, but that was not what the C. of A. was intended for.

Mr. Handley Page said he sometimes wondered whether a C. of A. was wanted at all. He recalled that the present position had developed from war conditions, when the Government was the only customer. So grew up the present system of "approved" firms. If the development had started in a more natural way, more like the motor car industry, for instance, this would not have happened. It seemed to him that the Government's interest in civil aircraft was only a "grandmotherly" one. On the other hand, the buyer of aircraft, and the operator of aircraft were the people best qualified to judge. The man who bought a machine would take good care to make sure it was sound. He did not want to be killed by the machine being weak. So also with the aircraft operator. If his machines were not sound, people would not travel in them.

He would like to draw attention to one or two cases in which the C. of A. regulations went wrong. For instance, in large aircraft the fuselage stresses were governed, in the C. of A. regulations, by the conditions of the nose dive case. Now it was impossible for the pilot to apply his controls in such a manner as to put the machine into that condition. The result was that the fuselage of a large machine was heavier than it need be. The other case he would like to mention referred to the size of rudders for control near and at the stall. With modern lateral controls such large rudders were not required.

The lecturer had referred to the difference between "acrobatic" and "normal" requirements. It was essential that experimental evidence should be made available. The need for this was illustrated by the lecturer's remark that they took about two-thirds of the "acrobatic" category as about right for the "normal."

Concerning international agreement on the subject, Mr. Handley Page pointed out that the British C. of A. demanded a standard which was 10 to 15 per cent. above that of the I.C.A.N. The position was found to be that some countries were satisfied with the minimum standards laid down, while others thought it advisable to have a factor of safety over and above those standards. The foreign factors of 10 or 12, based on sand load tests, might not actually represent machines stronger than the British, which had much lower *calculated* factors.

Mr. Handley Page concluded by pleading for more flexibility in the regulations. He thought that the far-reaching

effects of regulations were not always realised. For instance, alterations demanded during construction, particularly during construction of a type which had gone into production, were likely to increase the cost of the aircraft quite considerably.

Major Mayo said the work of the airworthiness department had played a very large part in establishing the high reputation which British aircraft now held. He did not agree with Mr. Handley Page that the C. of A. could be abolished altogether. It might be quite safe to do so in the case of well-established firms, but new firms were sure to be established, and they should have certain minimum requirements to work to. He would like to pay a tribute to the A.I.D. and to the liberal interpretation of the regulations.

Sir Sefton Brancker had referred to the insurance and operating companies taking over some of the work. The two shipping companies which had recently taken up aircraft were prepared to do a good deal of work independently, but they did not wish to see the Government regulations abolished.

Referring to the subject of where an aircraft was to operate, Major Mayo said that a machine might be quite safe in Northern Europe, but the same machine might easily become unsafe if operated in the tropics. The main structure of a British civil machine never failed nowadays, but detail fittings did fail. He thought that if the regulations concerning the main structure could be somewhat relaxed, the weight thus saved should be put into the detail fittings, thus making them more durable.

The lecturer had referred to collisions, and stated that they did not usually result in injury. On the contrary, he thought collision was the thing to be dreaded most of all, and if in the past, with but relatively little flying being done, there had been 25 collisions out of a total number of 107 accidents, he was very much afraid that in the future, with many more machines flying, they were going to have very large numbers. In the future, the present regulations governing vision of the pilot would be totally inadequate. When the air became really congested, they would need perfect visibility.

Capt. de Havilland said he disagreed with almost everything Major Mayo had said. For instance, he could not agree that the interpretation of the regulations had in the past been liberal. If they *must* have regulations, they should be cut down to a minimum. He felt that an international agreement was essential. Otherwise, British constructors would not be able to compete with foreign.

Capt. C. C. Walker congratulated Mr. Howard on his treatment of a subject that could easily have been obscured by a mass of detail. There was, however, this drawback to that treatment, that anyone not familiar with the subject might think that structural strength and take-off were the only conditions to be met in obtaining a C. of A. They would, no doubt, be surprised to learn that everything which the constructor touched, and every operation he performed, whether he was " approved " or not, was subject to regulation.

People in the aircraft industry, Capt. Walker said, had become so accustomed to regulations that they had to project their minds into some other industry to realise the extent of those regulations.

How, he asked, would a motor-car manufacturer fare, if, besides satisfying himself and his customers, he had to convince a Government Department about everything he did, and every material he used—his speedometers, tyres, petrol cocks, gauges, nuts, bolts, how he locked his nuts, and how he tested his engines ? If he made a modification, say, to the height of his dash or windscreen, or the weight or shape of his car, his steering gear, etc., he might have to send his car to a Government institution before being allowed to market it, where the amount of load it could carry, and the position of the load would be determined by experiments made without knowledge of its destination or use. There might be a long delay in which sufficiently neutral or adverse conditions could be encountered and when he obtained a certificate the document would inform the user that if he carried more than " x " passengers—" x " being calculated at 13 stone each, he must only go straight and not turn corners abruptly. The general tone would guard against the user jumping to the conclusion that he had got hold of a good car. His 1930 model might, with luck, come out in 1931, but his troubles would not be over, for the Government department could circularise his customers without his foreknowledge, and always in the same warning strain. Some parts of his car might become non-approved for no reason that he or his customers could see. He would also be in a continual state of worry lest the trickle of new regulations might suddenly put him out of date and stop his production. If he went out for an order from overseas with a small modification to type, he could not give an acceptable delivery date because he did not know what procedure might be adopted by the Department. He had to prove to the Government that each subsequent machine was identical with the type, and then pay a sum of money on each one he produced. On one type of aircraft alone, this sum last year would have permitted the continual employment of about 25 additional skilled workmen.

This machinery of certification had grown up while the Government was practically the only customer, with the result that the new civil industry had to struggle into existence loaded with preconceived restrictions. Why should it not be recognised that an " approved firm " the whole of whose design and construction was done under the eyes of Air Ministry representatives, was capable of making its own technical decisions. No regulations could alter the fact that the safety of aircraft depended upon the ability and experience of those who designed and made them.

The present division of functions between constructor and Air Ministry, in which the Air Ministry had absolute control over both design and construction without being concerned about the efficiency of the product, or even knowing what it was to compete against, was not rational and would be impossible under competitive conditions. It had only been possible to get along at all owing to the helpful goodwill shown by the Air Ministry in making this cumbrous machinery work. In particular, the industry owed much to Sir Sefton Brancker and Air Commodore Holt.

He hoped and believed that under the present *regime* all these things were going to get better, but trade was a matter of seizing opportunities, and time was important.

Mr. Howard had put the position as regards structural strength requirements so clearly and comprehensively that he (Capt. Walker) could only express agreement with every word he had said. His analysis of accidents was also particularly interesting and informing.

So far as the " take off " and " climb " requirements were concerned, since the amount of load which could be safely taken off by an aeroplane varied in an extreme degree with the situation and circumstances, and a " safe " amount could never be specified except by someone on the spot within five minutes of the flight, it should not be made a condition of airworthiness. While it gave a very good description of the capabilities of the machine, and was quite suitable for regular air liners operating from Croydon, it became an absurdity when used to limit the paying load to the same extent in a small field in, say, Kenya, as on a prairie in Brazil.

Capt. Walker agreed that the idea of international minimum standards was quite appalling in its difficulty, and as Mr. Howard had said, there would be no finality to it ; and it all meant very little, for the reasons he had indicated, especially use, maintenance, and varying levels of inspection. Why, he asked, could not the I.C.A.N. be left to settle the things that it was obviously useful to have settled internationally —such as rules of navigation, lighting, controls working the same way, etc. No one was going to build dangerous aircraft intentionally, and if unintentional the I.C.A.N. would not save them and the public would not use them.

In conclusion, he would suggest that the " get off " and " climb " requirement be eliminated as a condition of airworthiness, and merely stated as part of the performance, and that the machinery of the " approved firm " scheme be used to free the constructor from the present restrictions.

Air-Commodore Holt, Director of Technical Development, pointed out that every effort was being made to relax, as far as possible the present restrictions. But this all took time, and he would plead for patience a little longer. In the case of " approved " firms, the R.T.O. (Resident Technical Officer) would ultimately be made responsible. Firms which were not " approved " would, he was afraid, have to go on under present conditions. But as soon as they were considered worthy of being "approved," they would be, as the Air Ministry was willing and anxious to help in every way.

Major Barlow drew a parallel between what had happened in the Victorian era in the matter of shipping, and what might happen in modern times with aircraft. The Victorian policy concerning shipping regulations had resulted in very high standards, and in British prestige. He did not see why the same should not happen in the case of aircraft.

He pointed out that, concerning the relative standards of the British C. of A., and those of the I.C.A.N., we in this country used the yield or proof stress, while the I.C.A.N. regulations contained the expression " collapse." He thought the Airworthiness Handbook overstepped the limits by going into far too much detail. For instance, it laid down exactly how a safety belt should be made and fastened. He failed to see how this could have anything to do with the soundness of the aircraft.

Major Buchanan, Assistant Director (Aircraft), said the previous speakers had said practically all that he wished to say, and probably had said it a great deal better than he would have done. It was very essential that accidents should be avoided, and the safety of flying established. At present, he thought 99 per cent. of the British public regarded flying as highly dangerous, and he wasn't sure that they were not right. It had been hoped that the insurance companies would increase the requirements to suit individual conditions, leaving the Air Ministry to lay down minimum requirements. As regards the desire to abolish Government regulations, he knew of no form of transport vehicle which did not require some form or other of licence, from the elaborate regulations applying to shipbuilding, to the simple Scotland Yard licence for taxis. He doubted whether, if Government regulations were abolished, the constructors would find the insurance companies as nice to deal with as the Air Ministry.

Reference had been made to the prestige which the British C. of A. had given British aircraft. As one of the British representatives on the I.C.A.N., he had not found this view shared. In fact, his greatest difficulty had been to convince the representatives of other countries that the British factors were high enough. Theirs were nominally greater. British materials were the best in the world, and that helped to make up for any *apparent* deficiency in load factors. He would like to mention a fact which did not appear to be generally realised, but which he understood *was* a fact, and that was that when a British machine was built in the United States, it had to be stiffened up before it would pass the American regulations.

Mr. Radcliffe thought machines ought to be divided into air liners and machines for private use, the former to be subject to regulations, but the latter being left to the constructors, complete stress calculations being submitted in the case of a new type, so as to convince the Air Ministry that the calculations had been properly carried out. He pointed out that it would be quite feasible to produce a machine which would pass the regulations and get its C.of A., but which would, shortly after passing the Martlesham tests, break up in the air.

Mr. Bramson also maintained that the C. of A. was no guarantee of airworthiness, and that therefore the position was illogical. He pleaded for a better view, for example. It could not be claimed that a vehicle in which the driver's view was obstructed in the direction in which he wished to go was a sound proposition. Yet that was the case with single-engined aircraft, and was equivalent to a motor car in which the windscreen was covered with some opaque material.

Capt. Balfour made some very witty and cutting, but perfectly sound, remarks about the present regulations. It was, he said, only due to the liberal spirit in which those in charge at present interpreted and applied the regulations that it was possible to carry on at all. If a set of new officials were suddenly appointed, who followed the letter of the law and carried it out to its logical conclusion, he was sure the firms now building civil aircraft would very quickly be compelled to close down.

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THE ROYAL AERO CLUB OF THE U.K.

OFFICIAL NOTICES TO MEMBERS

REPORT of meeting of the committee of the Royal Aero Club, held at 3, Clifford Street, London, W.1., on Wednesday, January 22, 1930, at 5 p.m.

Present.—The Right Hon. Sir Philip Sassoon, Bart., P.C., G.B.E., C.M.G., M.P., in the chair; Air Vice-Marshal Sir Sefton Brancker, K.C.B., A.F.C., Mr. G. Brewer, Capt. H. S. Broad, Lieut.-Col. M. O. Darby, Major A. R. Goodfellow, Mr. F. Handley Page, Major H. A. Petre, D.S.O., M.C., Lieut.-Col. M. O'Gorman, C.B., Capt. C. B. Wilson, M.C., H. E. Perrin, secretary.

Election of Members.—The following members were elected:—Reginald Blake, Robert Arthur Bruce, Donald Phillips Cameron, Ashley Gordon Haward, Flight-Lieut. Ernest Alton Healy, Lieut. Owen Cathcart-Jones, Archibald Rutherford McDougall, Flying Officer William Richard Massey, Ashton Christopher Mills, Flight-Lieut. Archer, Robert Prendergast, Anthony Christopher Loraine Rendel, Robert Hugh McCoubrey Sheppard, Willy Zietz, George Villiers.

Aviators' Certificates.—The following Aviators' Certificates were granted:—

8918 Walter T. Couchman, Hampshire Ae. C.
8919 Andrew T. Davies, Newcastle Ae. C.
8920 Jose Luis de Olaso, National Fl. Services.
8921 Ahmed Mohamed Hassanein Bey, Airwork Fl. School
8922 Fred Siegfried Kramer, National Fl. Services
8923 Henry V. Williams, London Ae. C.
8924 Charles K. J. Radcliffe, National Fl. Services
8925 Lionel Mills, National Fl. Services
8926 Marjory Penrose-Thackwell, National Fl. Services
8927 Norman C. Leslie-Lowth, National Fl. Services
8928 Geoffrey J. W. Oddie, Cinque Ports Fl. C.
8929 Charles P. Parkerson, Cinque Ports Fl. C.
8930 Horace F. Fellowes, National Fl. Services
8931 Frank L. Dean, Liverpool & District Ae. C.
8932 Violet Baring, Airwork Fl. School
8933 Frederick A. White, National Fl. Services
8934 Richard M. Clarkson, London Ae. C.
8935 Samuel Griffith, Hampshire Ae. C.
8936 Samuel E. H. Spencer, Hampshire Ae. C.
8937 Arthur D. Sullivan, London Ae. C.
8938 Ronald G. Gallien, National Fl. Services
8939 John D. Turner, Airwork Fl. School
8940 Kenneth A. K. MacEwen, Berks, Bucks & Oxon Ae. C.
8941 Walter B. Henderson, Phillips & Powis Fl. School
8942 Philip J. T. Baddiley, Cinque Ports Fl. C.
8943 Eric L. Mays, Newcastle Ae. C.
8944 Harry Bolsover, Lancashire Ae. C.
8945 David N. Roberts, Berks, Bucks & Oxon Ae. C.
8946 Kenneth E. Parker, Royal Air Force.
8947 Michael D. L. Scott, Berks, Bucks & Oxon. Ae. C.
8948 Charles, J. Sanders, Hampshire Ae. C.
8949 George S. Walpole, Brooklands Fl. School
8950 Charles M. Brown, Berks, Bucks & Oxon Ae. C.

Britannia Trophy.—The Britannia Trophy for the year 1929 was unanimously awarded to the Hon. Lady M. Bailey, D.B.E., for her flight from England to South Africa and back, which was completed on January 16, 1929.

Banquet—February 5, 1930.—The arrangements for the Banquet to be held on February 5 were reported and approved.

"A" Licences.—Major A. R. Goodfellow and H. E. Perrin were appointed delegates to represent the club at the Air Ministry Conference to be held on January 30, 1930.

Annual General Meeting.—It was decided to hold the Annual General Meeting of the Club on Wednesday, March 26, 1930.

Lloyd's Register of Shipping.—The appointment of Sir Philip Sassoon to represent the Royal Aero Club on the Aviation Advisory Committee was reported.

F.A.I. PARIS CONFERENCE

Lieut-Colonel M. O'Gorman presented his report of the meeting of the Committee of the Fédération Aéronautique Internationale held in Paris on January 17, 1930, at which the following decisions were arrived at:—

Annual Conference.—It was decided that the Annual Conférence of the F.A.I. should be held in Paris on June 10-15, 1930, at the invitation of the Minister for Air.

Schneider Contest, 1931.—The regulations for the 1931 contest were considered and the recommendations of the Royal Aero Club were adopted.

It was decided to do away with the Watertightness and Navigability Tests, and substitute a "getting-off" and an "alighting" test to be carried out immediately prior to the speed contest, the whole contest taking place on one day.

The closing date of entries was put forward to July 31, 1930.

Clubs entering would be required to deposit with the Royal Aero Club a sum of 200,000 francs (French) per aircraft, entered, as a guarantee of participation.

The contest would take place between June 1 and September, 30, 1931, and the exact date would be fixed three months prior to the date.

International Touring Competition, 1930.—The regulations for the 1930 competition, to be organised by the Aero Club of Germany, were drawn up. The date of the competition was fixed for July 20 to August 7, 1930. The following countries would take part:—Germany, Spain, France, England, Poland, Switzerland and Czecho-Slovakia.

The start and finish would be at Berlin, and the circuit of approximately 7,50 km. involves obligatory stops at the following towns:—Brunswick, Frankfort, Rheims, St. Inglevert, Bristol, London, Paris, Poitiers, Pau, Madrid, Seville, Barcelona, Nimes, Lyon, Lausanne, Berne, Munich, Vienna, Prague, Breslau, Cracow, Warsaw, Konigsberg or Dantzig.

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W.1.
H. E. PERRIN, Secretary.

THE ROYAL AIR FORCE

London Gazette, January 21, 1930.

General Duties Branch

To be Silyn-Roberts is granted a permanent commn. as Pilot Officer, with effect from Jan. 11, and with seniority of Jan. 11, 1929; J. K. Brew is granted a short-service commn. as Pilot Officer on probation, with effect from and with seniority of Jan. 4. The following Pilot Officers are promoted to rank of Flying Officer:—T. W. G. Eady, E. Rotherham (Nov. 25, 1929); R. E. Watts (with seniority of Nov. 25, 1929) (Nov. 27, 1929); A. K. H. Bailey, F. C. E. Hayter, J. C. L. Claxton, H. E. Sales, D. L. Iremonger (Dec. 29, 1929).

Wing Commander O. T. Boyd, O.B.E., M.C., A.F.C., ceases to be seconded for duty at the Staff College, Camberley (Jan. 1); Wing Commander T. L. Leigh-Mallory, D.S.O., is seconded for two years' duty at the Staff College, Camberley (Jan. 1); Sqdn.-Ldr. H. Dawes, M.B.E., is placed on retired list (Jan. 22). The following Flying Officers are transferred to Reserve (Jan. 17). *Class J.*—R. L. Burnett, D. S. Green, N. K. Howard, C. P. Vines. *Class C.*—R. D. Adams, J. C. Noel.

Flying Officer E. Addis relinquishes his short-service commn. on account of ill-health (Jan. 17). The short-service commns. of the following Pilot Officers on probation are terminated on cessation of duty:—G. W. Stranraer-Mull (Jan. 9); R. J. B. Hitchin-Kemp, H. Travis (Jan. 21).

Stores Branch

The following are granted permanent commns. as Pilot Officers on probation, with effect from and with seniority of Jan. 19:—F. C. Read, W. A. Lee-L. Llewellyn, E. N. Lowe, J. W. C. Revill, G. C. Allen, B. S. Cartmel.

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The following Pilot Officers are promoted to rank of Flying Officer:—P. F. England, W. W. L. Jones, G. H. Newberry (Jan. 2); G. Nelson (Jan. 3); J. W. Carmichael (Jan. 9); M. J. R. Alderson, H. T. Edgecombe, D. R. Gray, G. J. E. Howard (Jan. 10); S. R. Herringshaw (Jan. 11); T. H. W. Beadle, F. C. Fisher, F. G. Hill, N. F. Marsh (Jan. 16); J. F. Legard (Jan. 17).

Flying Officer J. E. Preston is transferred from Class C to Class A (Jan. 3); Wing Commander J. P. C. Sewell, O.B.E., relinquishes his commn. on completion of service, and is permitted to retain his rank (Dec. 5, 1929); Flying Officer D. H. Geeson relinquishes his commn. on completion of service (Jan. 15); Pilot Officer on probation J. K. Brew relinquishes his commn. in Special Reserve on appointment to a short-service commn. in R.A.F. (Jan. 4).

Medical Branch.

Flight-Lieut. F. T. Boucher resigns his commn. on appointment to a commission in Royal Army Medical Corps (July 10, 1929).

AUXILIARY AIR FORCE

General Duties Branch.

No. 603 (CITY OF EDINBURGH) (BOMBER) SQUADRON.—The following Pilot Officer to be Flying Officer:—A. H. Bruce (Dec. 9, 1929).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Air Vice-Marshal H. C. T. Dowding, C.B., C.M.G., to H.Q., Fighting Area, Uxbridge, 4.1.30, on appointment as Air Officer Commanding.

Air Commodore The Hon. J. D. Boyle, C.B.E., D.S.O., to H.Q., Air Defence of Gt. Britain, Uxbridge, 10.1.30, for duty as Chief Staff Officer.

Group Captains: E. L. Gossage, D.S.O., M.C., to Special Duty List, 15.1.30, on appointment as Air Attaché, Berlin, vice Group Capt. M. G. Christie, C.M.G., D.S.O., M.C. E. M. Murray, D.S.O., M.C., to R.A.F. Depot, Uxbridge, 21.1.30—supernumerary.

Wing Commanders: B. L. Huskisson, D.S.C., to H.M.S. *Glorious*, 7.1.30, for duty as Sen. R.A.F. Officer in H.M.S. *Glorious* (on commissioning). L. T. N. Gould, M.C., to R.A.F. Depot, Uxbridge, 3.1.30; supernumerary. G. R. Macf. Reid, D.S.O., M.C., to R.A.F. Staff College, Andover, 29.12.29, supernumerary. O. T. Boyd, O.B.E., M.C., A.F.C., to Air Ministry (Department of C.A.S.) (D.O.S.D.), 4.1.30, on appointment as Deputy Director of Staff Duties, vice Group Capt. E. L. Gossage, D.S.O., M.C. J. C. M. Lowe, to H.Q., Inland Area, 20.1.30, for Air Staff (Armament) Duties. A. A. B. Thomson, M.C., A.F.C., to Air Ministry (Department of A.M.S.R.), 20.1.30, on appointment as Asst. Director (Armament). R. P. Willock, to R.A.F. Depot, Uxbridge, 22.1.30. R. D. Oxland, O.B.E., to R.A.F. Depot, Uxbridge, 22.1.30. P. C. Sherren, M.C., to R.A.F. Depot, Uxbridge, 20.1.30. R. Graham, D.S.O., D.S.C., D.F.C., to R.A.F. Station, Kenley, 1.1.30, to command.

Squadron Leaders: G. C. Pirie, M.C., D.F.C., to R.A.F. Staff College, Andover; 1.1.30. D. F. Stevenson, D.S.O., M.C., to R.A.F. Depot, Uxbridge; 6.1.30. R. G. Gardner, D.S.C., to Air Ministry (Dept. of A.M.P.) (D.P.S.); 6.1.30. W. A. C. Morgan, M.C., to No. 10 Sqdn., Upper Heyford; 30.12.29. G. G. Dawson, to R.A.F. Staff Coll., Andover: 29.12.29. M. L. Taylor, A.F.C., to Sch. of Photography, S. Farnborough; 11.12.29. A. N. Gallehawk, A.F.C., to H.Q., Inland Area; 28.12.29. E. G. Hopcraft, D.S.C., to R.A.F. Depot, Uxbridge; 29.12.29. G. C. Rhodes, to No. 2 Flying Training Sch., Digby; 23.11.29. H. W. Woollett, D.S.O., M.C., to No. 23 Sqdn., Kenley; 15.1.30. H. H. Mac. L. Fraser, to R.A.F. Staff Coll., Andover; 20.1.30. W. R. Cox, M.C., A.F.C., to R.A.F. Staff Coll., Andover; 20.1.30. R. S. Lucy, A.F.C., to No. 10 Group H.Q., Lee-on-Solent; 14.1.30. G. E. Godsave, to R.A.F. Depot, Uxbridge; 15.1.30. E. F. Turner, A.F.C., to No. 201 Sqdn., Southampton; 17.1.30.

Pilot Officers: F. Read, to No. 17 Sqdn., Upavon, 21.12.29. D. F. Satchwell, to No. 16 Sqdn., Old Sarum, 21.12.29. G. D. W. Frayling, to R.A.F. Depot, Uxbridge, 5.12.29. The undermentioned Pilot Officer are all posted to the R.A.F. Depot, Uxbridge, on appointment to Short Service Commns., on probation, with effect from 27.12.29:—C. E. Alven, D. J. Alvery, W. B. Bailey, J. Bamber, E. V. N. Bramley, R. A. Byrne, M. G. C. Chadwick, R. F. Chester, H. MacK. Chubb, A. R. T. Coke, C. W. W. S. Conway, L. E. Dalrymple, E. Elgey, C. J. Farrell, E. MacK. Gurney, G. J. Holland, D. Holt, L. W. V. Jennens, A. W. R. Lawson, R. P. J. Legborne, N. S. Lesmere, D. W. Lucke, R. A. McMurtrie, R. J. R. H. Makgill, W. R. Ottewill, W. C. Pitts, W. T. Ratcliffe, B. P. Reynolds, H. W. Riley, A. C. Sant, L. B. B. Stonhill, M. F. Summers, W. B. Thompson, G. R. White, R. B. Whittingham, A. R. Wilson, and F. Woodward.

Stores Branch

Wing Commander E. W. Havers, to H.Q., Air Defence of Gt. Britain, Uxbridge, for Stores Staff duties, 14.12.29.

Squadron-Leaders: F. R. Wilkins, to Aeroplane & Armament Experimental Establ., Martlesham Heath, 12.12.29. W. C. Clark, to Air Ministry (D. of E.), 6.1.30.

Flight Lieutenants: C. E. Tidy, to Armament & Gunnery Sch., Eastchurch, 21.12.29. C. H. Masters, to Aircraft Depot, Iraq, 3.1.30. G. Baker, to No. 1 Sch. of Tech. Training (Apprentices), Halton, 8.1.30.

Flying Officers: J. W. Hustwaite, to R.A.F. Depot, Middle East, 3.1.30. D. G. McDiarmid, to R.A.F. Depot, Middle East, 3.1.30. E. N. A. Crowe-Browne, to Aircraft Depot, Iraq, 3.1.30.

Accountant Branch

Flight Lieutenant J. H. S. Richards, to H.Q., Iraq Command, 24.11.29.
Flying Officer K. A. Jackman, to H.Q., Iraq Command, 7.12.29.

Chaplains Branch

Revd. D. F. Blackburn, to H.Q., R.A.F., Cranwell, 7.1.30.

NAVAL APPOINTMENTS

The following appointments have been made by the Admiralty:—

Lieut., R.N., F./O., R.A.F.—H. R. M. Nicholl, to *Adamant* (Dec. 30).

Lieuts.—J. D. C. Little, J. H. McI. Malcolm, H. Wright, and O. F. L. Bullock, attached to R.A.F. (Jan. 12), and R. W. Wicks (F./O., R.A.F.), to *Furious*.

Mate.—L. E. Ricketts, attached to R.A.F. (Jan. 12).

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Royal Air Force. Award of Prize Cadetships

THE AIR MINISTRY announces:—The Air Council have awarded Prize Cadetships each of the value of £105 per annum for two years to the following successful candidates at the examination held in November last for entry into the Royal Air Force College, Cranwell:—G. H. O. Mills (Plymouth College), R. H. A. Leigh (Cheltenham College), N. G. Goodman (City of London School), R. H. E. Emson (Christ's Hospital), J. S. Chadd (Framlingham College), H. P. Jenkins (King's College, Taunton, Somerset).

Flight Cadetships for Aircraft Apprentices. "Sir Charles Wakefield" Scholarships Awards

THE AIR MINISTRY announces:—Aircraft Apprentices S. W. Needham and E. F. Porter from No. 1 School of Technical Training (Apprentices), Halton and Aircraft Apprentices R. Monks and A. Pyke from the Electrical and Wireless School, Cranwell, have been selected for cadetships at the R.A.F. College, Cranwell, on the result of the examinations held on completion of their three years' training as aircraft apprentices.

"Sir Charles Wakefield" Scholarships valued at £75 each have been awarded to Flight Cadet D. V. Johnson on the result of the recent competitive examination for entry into the R.A.F. College and to Flight Cadet S. W. Needham. The "Hyde-Thomson Memorial Prize," valued at about £33, has been awarded to Flight Cadet R. Monks.

600 Vacancies for R.A.F. Aircraft Apprentices

THE AIR MINISTRY announces:—Six hundred aircraft apprentices, between the ages of 15 and 17, are required by the Royal Air Force for entry into the Schools of Technical Training at Halton, Bucks., and at Cranwell, near Sleaford, Lincs. They will be enlisted as the result of an Open Competition and of a Limited Competition which will be held in the near future by the Civil Service Commissioners and the Air Ministry respectively. Successful candidates will be required to complete a period of twelve years' regular Air Force service from the age of 18, in addition to the training period. At the age of 30 they may return to civil life or may be permitted to re-engage to complete time for pension.

Full information regarding the dates of the respective examinations, the methods of entry and the aircraft apprentice scheme generally can be obtained upon application to the Royal Air Force (Aircraft Apprentices' Dept.), Gwydyr House, Whitehall, London, S.W.1. The sons of officers, warrant officers and senior N.C.Os. of the three services will receive special consideration.

The scheme offers a good opportunity to well-educated boys of obtaining a three-years' apprentice course of a high standard, and of following an interesting technical career. Already over 6,000 aircraft apprentices have completed their training at the technical schools of the Royal Air Force, and the annual output is approximately 1,000 fully-trained aircraftmen.

The principal trades open to boys are metal rigger, a new trade brought into existence by the introduction of the metal aeroplane, which involves training in both fitting and sheet metal work; fitter (aero engine); fitter (driver, petrol); fitter (armourer); coppersmith and metal worker; wireless operator-mechanic and electrician. The apprentices are given a thorough training in their trade by highly qualified technical instructors, and their general education is also carried on simultaneously by a staff of graduate teachers.

During the training period the rate of pay is 1s. a day for the first two years, and 1s. 6d. a day thereafter, until the apprentice has both attained the age of 18 and been posted to a unit on completing his training. When he is posted to a unit for duty as an aircraftman, the commencing rate of pay varies from 3s. 3d. to 5s. 6d. a day (22s. 9d. to 38s. 6d. a week), according to the marks obtained in the passing out examination. He also receives free board and lodging and a uniform allowance. Subsequently, there is the prospect of promotion, on passing certain prescribed tests.

A few apprentices of special promise proceed to the Royal Air Force College (all their fees thereat being remitted) for training with a view to becoming Commissioned Officers.

For the remainder, opportunities arise later to volunteer to qualify in flying and become airman pilots. Between 100 and 120 are selected annually from volunteers of all trades. From amongst airman pilots a few are periodically selected for commissioned rank.

R.AE.S. AND INST.AE.E.

Official Notice

ON Thursday, February 6, 1930, at 6.30 p.m., Mr. J. W. Maccoll will lecture before the Royal Aeronautical Society on Modern Aerodynamical Research in Germany. The Lecture, which will be illustrated, will be read in the Lecture Hall of the Royal Society of Arts, 18, John Street, Adelphi, W.C. 1.

Mr. Maccoll, who has been making a special study in Germany of modern German research upon the motion of incompressible fluids, divides his paper into three parts :—

1. The theory of the boundary layer and its application for laminar and turbulent conditions.

2. An account of the experimental investigations and theoretical work upon the development of turbulence.

3. The work being carried out at Gottingen and other German laboratories to determine the characteristics of fully-developed turbulence.

Mr. Maccoll has been in close touch with Professor Prandtl, Professor Betz and Professor von Karman, and much of the material in his lecture will be entirely new. The important work which is now being done in Germany will have an incalculable effect on design, and Mr. Maccoll's paper will bring before British designers the work which has been carried out in German laboratories since Professor Prandtl gave his classic lecture before the Society in 1927.

A lecture will be read before the Society by Senor J. de la Cierva on Thursday, February 13, at 6.30 p.m. in the Lecture Hall of the Royal Society of Arts. The lecture will be illustrated.

Senor J. de la Cierva will explain in detail the progress of the Autogiro since 1925. The progress which has been made is remarkable, not only from the practical point of view, but from the theoretical one, and Senor de la Cierva will describe how, since 1925, he has developed a theory which enables design to be carried much further than was possible in 1925. The lecturer shows why, ultimately, the Autogiro must become faster than the corresponding aeroplane. He says in the course of his lecture "In the present state of knowledge I am satisfied of the possibility of designing autogiros having a top speed of the order of two hundred miles an hour, and landing exactly the same as the light autogiros of the latest type." Senior de la Cierva obtains the remarkable result that the heavier an autogiro is the higher its top speed.

The Usborne Memorial Prize for the year 1929 has been awarded to Mr. F. G. Evans for his paper entitled "The Cross-Section of the Semi-Rigid Airship." The Usborne Memorial Prize is offered annually, at the discretion of the Council, for the best paper by a student on lighter-than-air craft.

J. LAURENCE PRITCHARD, *Secretary.*

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THE MODEL AIRCRAFT CLUB (T.M.A.C.)

THE debate, "Heavy-Weight *versus* Light-Weight Model Aeroplanes," which will be held on Wednesday, February 19 (at 7 p.m.) at the Junior Institution of Engineers, 39, Victoria Street, Westminster, S.W.1, will be between Mr. W. J. Plater, of the Halton Model Aircraft Society, and Mr. T. Newell, Competition Secretary of the T.M.A.C. Mr. Plater will support heavy-weight machines, and Mr. Newell, light-weight.

On Wednesday, March 19, another interesting debate has been arranged at the above address between Mr. D. A. Pavely, the Technical Adviser of the T.M.A.C., and Mr. C. A. Rippon, the subject being Mechanically, *versus* Rubber-Driven Model Aeroplanes.—A. E. JONES, Hon. Sec., 48, Narcissus Road, West Hampstead, London, N.W.6.

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IN PARLIAMENT

Aviation Landing Grounds

MR. BENN (Secretary of State for India) on January 21, in reply to Major Pole, said the following civil landing grounds on air routes across India are normally fit for use throughout wet seasons: Karachi, Jodhpur, Delhi, Allahabad, Gaya, Dum Dum. In addition there are approximately 40 Royal Air Force and Army Department landing grounds in various parts of India available for civil use under certain conditions which are normally fit. Government are working to a considered programme of progressive development of civil landing grounds on Indian routes as speedily as the funds available will permit.

Air Pilots' Licences

MR. BENN further stated the number of persons holding air pilot's licences in India is as follows :—"A" licences, 61 ; "B" licences, 25.

The number of such licences issued during 1929 was "A" licences, 56 ; "B" licences, 21.

Parachutes

THE UNDER-SECRETARY OF STATE FOR AIR (Mr. Montague), on January 22, in reply to Capt. H. Balfour, said the provision of parachutes for the crews of aircraft when flying over the sea is regarded as a matter of great importance, but a difficult mechanical problem is involved, namely, to devise a form of parachute harness enabling the wearer to divest himself of encumbrances in a confined space in the least possible time if his machine falls into the water. Exhaustive trials and experiments extending over more than four years have been carried out with forms of quick release to enable the wearer to get rid of his parachute equipment. I am hopeful that the latest design of quick release will be adequate for sea-going aircraft other than those flying on and off ships' decks, and that one of the types of equipment recently under trial in the Fleet, although not fulfilling all the desired conditions, will be found sufficiently satisfactory for these latter aircraft. If this is confirmed, provision will be made as early as possible.

Indian Air Force

MR. BENN, on January 23, in reply to Major Pole, said the creation of an Indian air force forms part of the accepted policy of Indianisation, and is already under consideration. Matters have not yet advanced far enough to enable me to give any details as to the constitution or future functions of such a force.

Air Force in India

MR. BENN, on January 27, in reply to Brigadier-General Clifton Brown, said there are eight squadrons of the Royal Air Force in India, with about 260 officers and 2,000 other ranks. No change is at present contemplated.

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PERSONALS

Married

The marriage between Flight-Lieutenant HUGH MARKHAM DAVID, R.A.F., son of Lt.-Col. M. David, D.S.O., and Mrs. David, of Warwick Mansions, Cromwell Crescent, S.W., and Miss GERALDINE CAMERON MACKENZIE, daughter of the late Rev. Angus Cameron Mackenzie, of Dundee, and of Mrs. Cameron Mackenzie, of 49, St. Petersburgh Place, W., took place on January 9, at Holy Trinity Church, Brompton. Flight-Lieut. E. H. Fielden was best man.

To be Married

The engagement is announced of GEORGE KENNETH HORNER, R.A.F., son of Mr. Charles H. HORNER and of the late Mrs. Horner, of Trimmingham, Halifax, and Miss HELEN AYKROYD SCADDING, daughter of the Rev. S. W. and Mrs. Scadding, of St. Jude's Vicarage, Halifax.

R.A.F. Sport

Rugby Football.—On January 22 the R.A.F. XV visited Cambridge and were beaten by the University by 3 goals, one penalty goal, and 3 tries (27 points) to 3 goals (15 points). The R.A.F. played much better in this match than they did against Bristol, but the Varsity (with only eight Blues playing) were too strong for them. The service team were without the Irish international forward, Beamish. Soon after the start F./O. White scored a try, which P./O. Llewellyn converted. Then York and Carris scored in turn for Cambridge, and one was converted. The R.A.F. could not resist the temptation to give away a free kick in their own twenty-five, and Carris scored a penalty goal. Then the Service had a turn, and F./O. Pott scored. Llewellyn again kicked the goal. Carris scored again before half-time. In the second half Cambridge scored three more tries through Cross, Brook, and Carris, two of which were converted. F./Lt. Odbert scored a clever try for the service, and Llewellyn kicked his third goal. The teams were :—

CAMBRIDGE UNIVERSITY.—J. G. Askew (Durham and Emmanuel), back ; H. E. Carris (Mill Hill and St. John's), L. H. Collison (Mill Hill and St. John's), G. C. A. Adams (Radley and Pembroke), and F. M. Heywood (Haileybury and Caius), three-quarter backs ; A. G. Cross (King's College School, Wimbledon, and Caius), and E. B. Pope (Uppingham and Clare), half-backs ; J. J. A. Embleton (St. Paul's and Caius), P. W. P. Brook (Whitgift and Emmanuel), D. M. Marr (Fettes and Caius), A. W. Walker (Oundle and Clare), N. A. York (Northampton and St. Catherine's), G. E. Valentine (Bishop's Stortford and St. Catherine's), A. C. Lusty (Rugby and Caius), and A. R. Ramsay (Harrow and Trinity Hall), forwards.

ROYAL AIR FORCE.—P./O. Nicholson, back ; F./O. White, P./O. Llewellyn, F./O. Pott, and F./O. Cotton, three-quarter backs ; F./L. Odbert and P./O. Elsmie, half-backs ; L./A. Robinson, P./O. Letchworth, Sergeant Kerby, P./O. Constantine, F./L. Franks, Sergeant Hall, L./A. Maxwell and F./O. Simpson, forwards.

Hockey.—The R.A.F. hockey XI did very well to beat the Civil Service at Bentley Priory, Stanmore, on January 22, by 2 goals to nil. The Civil Service team included an English international in Petheram and an old Cambridge Blue in Carpenter. Williams and Bufton scored the R.A.F. goals, both in the first half.

R.A.F. TEAM.—Cpl. C. Butler (Stanmore) ; Cpl. L. G. Beeton (Henlow), and F./O. W. K. Beisiegel (Donibristle) ; L./A. L. R. Hobbs (Uxbridge), Sergt. W. C. Maher (Upavon) and L./A. Adamson (Henlow), F./O. N. M. Jerram (Halton), A. C. Williams (Henlow), L./A. F. Connell (Gosport), F./O. S. C. Bufton (Bicester), and F./L. H. N. Hampton (Digby).

The Royal Air Force Memorial Fund

THE usual meeting of the Grants Sub-Committee of the Fund was held at Iddesleigh House, on January 9. Mrs. L. M. K. Pratt-Barlow, O.B.E., was in the Chair, and the other member of the committee present was Squadron Leader A. H. Wann. The committee considered in all 17 cases, and made grants to the amount of £304 17*s.*

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PUBLICATIONS RECEIVED

The Red Knight of Germany : Baron von Richthofen, Germany's Great War Airman. By Floyd Gibbons. Cassell and Co., Ltd., London, E.C.4. Price 7*s.* 6*d.* net.

Droit Aerien. Oct., Nov., Dec., 1929. Per Orbem, 4, Rue Tronchet, Paris.

The Air Pilot (*Volume I*), *Monthly Supplement No.* 4. *December,* 1929. H.M. Stationery Office, Kingsway, London, W.C.2. Price 6*d.*

Amendment List No. 3 *to Air Publication* 958. *November,* 1929. The King's Regulations and Air Council Instructions for the Royal Air Force, 1928. H.M. Stationery Office, Kingsway, W.C.2. Price 3*d.* net.

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AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations : Cyl. = cylinder ; i.c. = internal combustion ; m. = motor. (The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

APPLIED FOR IN 1928

Published January 30, 1930.

29,333. D. R. POBJOY. I.c. engines. (323,570.)

APPLIED FOR IN 1929.

Published January 30, 1930.

730. W. T. REID. Alighting-gear for aeroplanes. (323,644.)
731. W. T. REID. Operation of alighting-gear brakes. (323,645.)
5,511. G. CHECKLEY. Screw propellers. (323,677.)

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